JOURNAL

AND

PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

NEW SOUTH WALES,

1879.

VOL. XIII.

EDITED BY

A. LIVERSIDGE,
Professor of Geology and Mineralogy in the University of Sydney.

THE AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR THE STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

AGENTS FOR THE SOCIETY
Messrs. Trübner & Co., 57, Ludgate Hill, London, E.C.

SYDNEY: THOMAS RICHARDS, GOVERNMENT PRINTER.

1880.

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NOTICE.

The Royal Society of New South Wales originated in 1821 as the "Philosophical Society of Australia"; after an interval of inactivity, it was resuscitated in 1850, under the name of the "Australian Philosophical Society," by which title it was known until 1856, when the name was changed to the "Philosophical Society of New South Wales"; and finally, in May, 1866, by the sanction of Her Most Gracious Majesty the Queen, it assumed its present title.

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The Royal Society of New South Wales.

OFFICERS FOR 1879–80.

HONORARY PRESIDENT:

HIS EXCELLENCY THE RT. HON. LORD AUGUSTUS LOFTUS, G.C.B., &c., &c., &c.

PRESIDENT:

VICE-PRESIDENTS

HON. J. SMITH, C.M.G., M.L.C., M.D., LL.D., &c.
CHARLES MOORE, F.L.S.

HONORARY TREASURER:

H. C. RUSSELL, B.A., F.R.A.S., F.M.S., &c. (*Resigned, July,* 1879.)
H. G. A. WRIGHT, M.R.C.S. (*Elected, August,* 1879.)

HONORARY SECRETARIES:

PROFESSOR LIVERSIDGE. | DR. ADOLPH LEIBIUS.

COUNCIL:

CRACKNELL, E. C.
DIXON, W. A., F.C.S.
HIRST, G. D.
HUNT, ROBERT, F.G.S.
MONTEFIORE, E. L.
ROLLESTON, C., C.M.G.

ASSISTANT SECRETARY:

W. H. WEBB.

INDEX TO RULES.

RULES.

(Revised October 1st, 1879.)

Object of the Society.

I. The object of the Society is to receive at its stated meetings original papers on Science, Art, Literature, and Philosophy, and especially on such subjects as tend to develop the resources of Australia, and to illustrate its Natural History and Productions.

Honorary President.

II. The Governor of New South Wales shall be *ex officio* Honorary President of the Society.

Other Officers.

III. The other Officers of the Society shall consist of a President, who shall hold office for one year only, but shall be eligible for re-election after the lapse of one year; two Vice-Presidents, a Treasurer, and one or more Secretaries, who, with six other Members, shall constitute a Council for the management of the affairs of the Society.

Election of Officers and Council.

IV. The President, Vice-Presidents, Secretaries, Treasurer, and the six other Members of Council, shall be elected annually by ballot at the General Meeting in the month of May.

V. It shall be the duty of the Council each year to prepare a list containing the names of members whom they recommend for election to the respective offices of President, Vice-Presidents, Hon. Secretaries and Hon. Treasurer, together with the names of six other members whom they recommend for election as ordinary members of Council.

The names thus recommended shall be proposed at one meeting of the Council, and agreed to at a subsequent meeting.

Such list shall be suspended in the Society's Rooms, and a copy shall be sent to each ordinary member not less than fourteen days before the day appointed for the Annual General Meeting.

VI. Each member present at the Annual General Meeting shall have the power to alter the list of names recommended by the Council, by adding to it the names of any eligible members not already included in it and removing from it an equivalent number of names, and he shall use this list with or without such alterations as a balloting list at the election of Officers and Council.

The name of each member voting shall be entered into a book, kept for that purpose, by two Scrutineers elected by the members present.

No ballot for the election of Members of Council, or of New Members, shall be valid unless twenty members at least shall record their votes.

Vacancies during the year.

VII. Any vacancies occurring in the Council of Management during the year may be filled up by the Council.

Candidates for admission.

VIII. Candidates must be at least twenty-one years of age.

Every candidate for admission as an ordinary member of the Society shall be recommended according to a prescribed form of certificate by not less than three members, to two of whom the candidate must be personally known.

Such certificate must set forth the names, place of residence, and qualifications of the candidate.

The certificate shall be read at the three Ordinary General Meetings of the Society next ensuing after its receipt, and during the intervals between those three meetings, it shall be suspended in a conspicuous place in one of the rooms of the Society.

The vote as to admission shall take place by ballot, at the Ordinary General Meeting at which the certificate is appointed to be read the third time, and immediately after such reading.

At the ballot the assent of at least four-fifths of the members voting shall be requisite for the admission of the candidate.

Fees.

IX. The entrance money paid by members on their admission shall be Two Guineas; and the annual subscription shall be Two Guineas, payable in advance; but members elected prior to December, 1879, shall be required to pay an annual subscription of One Guinea only as heretofore.

The amount of ten annual payments may be paid at any time as a life composition for the ordinary annual payment.

New Members to be informed of their election.

X. Every new member shall receive due notification of his election, and be supplied with a copy of the obligation (No. 3 in Appendix), together with a copy of the Rules of the Society, a list of members, and a card of the dates of meeting.

Members shall sign Rules—Formal admission.

XI. Every member who has complied with the preceding Rules shall at the first Ordinary General Meeting at which he shall be present sign a duplicate of the aforesaid obligation in a book to be kept for that purpose, after which he shall be presented by some member to the Chairman, who, addressing him by name, shall say:—"In the name of the Royal Society of New South Wales I admit you a member thereof."

Annual subscriptions, when due.

XII. Annual subscriptions shall become due on the 1st of May for the year then commencing. The entrance fee and first year's subscription of a new member shall become due on the day of his election.

Members whose subscriptions are unpaid to enjoy no privileges.

XIII. An elected member shall not be entitled to attend the meetings or to enjoy any privilege of the Society, nor shall his name be printed in the list of the Society, until he shall have paid his admission fee and first annual subscription, and have returned to the Secretaries the obligation signed by himself.

Subscriptions in arrears.

XIV. Members who have not paid their subscriptions for the current year, on or before the 31st of May, shall be informed of the fact by the Hon. Treasurer.

No member shall be entitled to vote or hold office while his subscription for the previous year remains unpaid.

The name of any member who shall be two years in arrears with his subscriptions shall be erased from the list of members, but such member may be re-admitted on giving a satisfactory explanation to the Council, and on payment of arrears.

At the meeting held in July, and at all subsequent meetings for the year, a list of the names of all those members who are in arrears with their annual subscriptions shall be suspended in the Rooms of the Society. Members shall in such cases be informed that their names have been thus posted.

Resignation of Members.

XV. Members who wish to resign their membership of the Society are requested to give notice in writing to the Honorary Secretaries, and are required to return all books or other property belonging to the Society.

Expulsion of Members.

XVI. A majority of members present at any ordinary meeting shall have power to expel an obnoxious member from the Society, provided that a resolution to that effect has been moved and seconded at the previous ordinary meeting, and that due notice of the same has been sent in writing to the member in question, within a week after the meeting at which such resolution has been brought forward.

Honorary Members.

XVII. The Honorary Members of the Society shall be persons who have been eminent benefactors to this or some other of the Australian Colonies, and distinguished patrons and promoters of the objects of the Society. Every person proposed as an Honorary Member must be recommended by the Council and elected by the Society. Honorary Members shall be exempted from payment of fees and contributions: they may attend the meetings of the Society, and they shall be furnished with copies of the publications of the Society, but they shall have no right to hold office, to vote, or otherwise interfere in the business of the Society.

The number of Honorary Members shall not at any one time exceed twenty, and not more than two Honorary Members shall be elected in any one year.

Corresponding Members.

XVIII. Corresponding Members shall be persons, not resident in New South Wales, of eminent scientific attainments, who may have furnished papers or otherwise promoted the objects of the Society.

Corresponding Members shall be recommended by the Council, and be balloted for in the same manner as ordinary Members.

Corresponding Members shall possess the same privileges only as Honorary Members.

The number of Corresponding Members shall not exceed twenty-five, and not more than three shall be elected in any one year.

Ordinary General Meetings.

XIX. An Ordinary General Meeting of the Royal Society, to be convened by public advertisement, shall take place at 8 p.m., on the first Wednesday in every month, during the last eight months of the year; subject to alteration by the Council with due notice.

Order of Business.

XX. At the Ordinary General Meetings the business shall be transacted in the following order, unless the Chairman specially decide otherwise:—

1—Minutes of the preceding Meeting.
2—New Members to enrol their names and be introduced.
3—Ballot for the election of new Members.
4—Candidates for membership to be proposed.
5—Business arising out of Minutes.
6—Communications from the Council.
7—Communications from the Sections.
8—Donations to be laid on the Table and acknowledged.
9—Correspondence to be read.
10—Motions from last Meeting.
11—Notices of Motion for the next Meeting to be given in.
12—Papers to be read.
13—Discussion.
14—Notice of Papers for the next Meeting.

Annual General Meeting.—Annual Reports.

XXI. A General Meeting of the Society shall be held annually in May, to receive a Report from the Council on the state of the Society, and to elect Officers for the ensuing year. The Treasurer shall also at this meeting present the annual financial statement.

Admission of Visitors.

XXII. Every ordinary member shall have the privilege of introducing two friends as visitors to an Ordinary General Meeting of the Society or its Sections, on the following conditions:—

1. That the name and residence of the visitors, together with the name of the member introducing them, be entered in a book at the time.
2. That they shall not have attended two consecutive meetings of the Society or of any of its Sections in the current year.

The Council shall have power to introduce visitors, irrespective of the above restrictions.

Council Meetings.

XXIII. Meetings of the Council of Management shall take place on the last Wednesday in every month, and on such other days as the Council may determine.

Absence from Meetings of Council.—Quorum.

XXIV. Any member of the Council absenting himself from three consecutive meetings of the Council, without giving a satisfactory explanation in writing, shall be considered to have vacated his office. No business shall be transacted at any meeting of the Council unless three members at least are present.

Duties of Secretaries.

XXV. The Honorary Secretaries shall perform, or shall cause the Assistant Secretary to perform, the following duties :—

1. Conduct the correspondence of the Society and Council.
2. Attend the General Meetings of the Society and the meetings of the Council, to take minutes of the proceedings of such meetings, and at the commencement of such to read aloud the minutes of the preceding meeting.
3. At the Ordinary Meetings of the members, to announce the presents made to the Society since their last meeting; to read the certificates of candidates for admission to the Society, and such original papers communicated to the Society as are not read by their respective authors, and the letters addressed to it.
4. To make abstracts of the papers read at the Ordinary General Meetings, to be inserted in the Minutes and printed in the Proceedings.
5. To edit the Transactions of the Society, and to superintend the making of an Index for the same.
6. To be responsible for the arrangement and safe custody of the books, maps, plans, specimens, and other property of the Society.

7. To make an entry of all books, maps, plans, pamphlets, &c., in the Library Catalogue, and of all presentations to the Society in the Donation Book.
8. To keep an account of the issue and return of books, &c., borrowed by members of the Society, and to see that thé borrower, in every case, signs for the same in the Library Book.
9. To address to every person elected into the Society a printed copy of the Forms Nos. 2 and 3 (in the Appendix), together with a list of the members, a copy of the Rules, and a card of the dates of meeting; and to acknowledge all donations made to the Society, by Form No. 6.
10. To cause due notice to be given of all Meetings of the Society and Council.
11. To be in attendance at 4 p.m. on the afternoon of Wednesday in each week during the session.
12. To keep a list of the attendances of the members of the Council at the Council Meetings and at the ordinary General Meetings, in order that the same may be laid before the Society at the Annual General Meeting held in the month of May.

The Honorary Secretaries shall, by mutual agreement, divide the performance of the duties above enumerated.

The Honorary Secretaries shall, by virtue of their office, be members of all Committees appointed by the Council.

Contributions to the Society.

XXVI. Contributions to the Society, of whatever character, must be sent to one of the Secretaries, to be laid before the Council of Management. It will be the duty of the Council to arrange for promulgation and discussion at an Ordinary Meeting such communications as are suitable for that purpose, as well as to dispose of the whole in the manner best adapted to promote the objects of the Society.

Management of Funds.

XXVII. The funds of the Society shall be lodged at a Bank named by the Council of Management. Claims against the Society, when approved by the Council, shall be paid by the Treasurer.

All cheques shall be countersigned by a member of the Council.

Money Grants.

XXVIII. Grants of money in aid of scientific purposes from the funds of the Society—to Sections or to members—shall expire on the 1st of November in each year. Such grants, if not expended, may be re-voted.

XXIX. Such grants of money to Committees and individual members shall not be used to defray any personal expenses which a member may incur.

Audit of Accounts.

XXX. Two Auditors shall be appointed annually, at an Ordinary Meeting, to audit the Treasurer's Accounts. The accounts as audited to be laid before the Annual Meeting in May.

Property of the Society to be vested in the President, &c.

XXXI. All property whatever belonging to the Society shall be vested in the President, Vice-Presidents, Hon. Treasurer, and Hon. Secretaries for the time being, in trust for the use of the Society; but the Council shall have control over the disbursements of the funds and the management of the property of the Society.

SECTIONS.

XXXII. To allow those members of the Society who devote attention to particular branches of science fuller opportunities and facilities of meeting and working together with fewer formal

restrictions than are necessary at the general Monthly Meetings of the Society,—Sections or Committees may be established in the following branches of science:—

Section A.—Astronomy, Meteorology, Physics, Mathematics, and Mechanics.

Section B.—Chemistry and Mineralogy, and their application to the Arts and Agriculture.

Section C.—Geology and Palæontology.

Section D.—Biology, *i.e.*, Botany and Zoology, including Entomology.

Section E.—Microscopical Science.

Section F.—Geography and Ethnology.

Section G.—Literature and the Fine Arts, including Architecture.

Section H.—Medical.

Section I.—Sanitary and Social Science and Statistics.

Section Committees—Card of Meetings.

XXXIII. The first meeting of each Section shall be appointed by the Council. At that meeting the members shall elect their own Chairman, Secretary, and a Committee of four; and arrange the days and hours of their future meetings. A card showing the dates of each meeting for the current year shall be printed for distribution amongst the members of the Society.

Membership of Sections.

XXXIV. Only members of the Society shall have the privilege of joining any of the Sections.

Reports from Sections.

XXXV. There shall be for each Section a Chairman to preside at the meetings, and a Secretary to keep minutes of the proceedings, who shall jointly prepare and forward to the Hon. Secretaries of the Society, on or before the 7th of December in each year, a report of the proceedings of the Section during that year, in order that the same may be transmitted to the Council.

Reports.

XXXVI. It shall be the duty of the President, Vice-Presidents, and Honorary Secretaries to annually examine into and report to the Council upon the state of—

1. The Society's house and effects.
2. The keeping of the official books and correspondence.
3. The library, including maps and drawings.
4. The Society's cabinets and collections.

Cabinets and Collections.

XXXVII. The keepers of the Society's cabinets and collections shall give a list of the contents, and report upon the condition of the same to the Council annually.

Documents.

XXXVIII. The Honorary Secretaries and Honorary Treasurer shall see that all documents relating to the Society's property, the obligations given by members, the policies of insurance, and other securities shall be lodged in the Society's iron chest, the contents of which shall be inspected by the Council once in every year; a list of such contents shall be kept, and such list shall be signed by the President or one of the Vice-Presidents at the annual inspection.

Branch Societies.

XXXIX. The Society shall have power to form Branch Societies in other parts of the Colony.

Library.

XL. The members of the Society shall have access to, and shall be entitled to borrow books from the Library, under such regulations as the Council may think necessary.

Alteration of Rules.

XLI. No alteration of, or addition to, the Rules of the Society shall be made unless carried at two successive General Meetings, at each of which, twenty-five members at least must be present.

THE LIBRARY.

1. During the Session, the Library shall be open for consultation and for the issue and return of books between 4 and 6 p.m. on the afternoon of each Wednesday, and between 7 and 10 p.m. on the evenings of Monday, Wednesday, and Friday, and during the recess (January to end of April) on Wednesdays, from 4 to 6 and 7 to 10 p.m.

2. No book shall be issued without being signed for in the Library Book.

3. Members are not allowed to have more than two volumes at a time from the Library, without special permission from one of the Honorary Secretaries, nor to retain a book for a longer period than fourteen days; but when a book is returned by a member it may be borrowed by him again, provided it has not been bespoken by any other member. Books which have been bespoken shall circulate in rotation, according to priority of application.

4. Scientific Periodicals and Journals are not to be borrowed until the volumes are completed and bound.

5. Members retaining books longer than the time specified shall be subject to a fine of sixpence per week for each volume.

6. The books which have been issued shall be called in by the Secretaries twice a year; and in the event of any book not being returned on those occasions, the member to whom it was issued shall be answerable for it, and shall be required to defray the cost of replacing the same.

Form No. 1.

ROYAL SOCIETY OF NEW SOUTH WALES.

Certificate of a Candidate for Election.

Name

Qualification or occupation

Address

being desirous of admission into the Royal Society of New South Wales, we, the undersigned members of the Society, propose and recommend him as a proper person to become a member thereof.

Dated this day of 18 .

FROM PERSONAL KNOWLEDGE.	FROM GENERAL KNOWLEDGE.

Signature of candidate

Date received 18 .

Form No. 2.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's Rooms,

Sir, Sydney, 18 .

I have the honor to inform you that you have this day been elected a member of the Royal Society of New South Wales, and I beg to forward to you a copy of the Rules of the Society, a printed copy of an obligation, a list of members, and a card announcing the dates of meeting during the present session.

According to the Regulations of the Society (*vide* Rule No. 9), you are required to pay your admission fee of two guineas, and annual subscription of two guineas for the current year, before admission. You are also requested to sign and return the enclosed form of obligation at your earliest convenience.

I have the honor to be,

Sir,

Your most obedient servant,

To Hon. Secretary.

Form No. 3.

ROYAL SOCIETY OF NEW SOUTH WALES.

I, the undersigned, do hereby engage that I will endeavour to promote the interests and welfare of the Royal Society of New South Wales, and to observe its Rules and By-laws, as long as I shall remain a member thereof.

Signed,

Address

Date

Form No. 4.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's Rooms,

Sir, Sydney, 18 .

I have the honor to inform you that your annual subscription of for the current year became due to the Royal Society on the 1st of May last.

It is requested that payment may be made by cheque or Post Office order drawn in favour of the Hon. Treasurer.

I have the honor to be,

Sir,

Your most obedient servant,

To Hon. Treasurer.

Form No. 5.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's Rooms,

Sir, Sydney, 18 .

I am desired by the Royal Society of New South Wales to forward to you a copy of its Journal for the year 18 , as a donation to the library of your Society.

I am further requested to mention that the Society will be thankful to receive such of the very valuable publications issued by your Society as it may feel disposed to send.

I have the honor to be,

Sir,

Your most obedient servant,

Hon. Secretary.

Form No. 6.

ROYAL SOCIETY OF NEW SOUTH WALES.

The Society's Rooms,

Sir, Sydney, 18 .

On behalf of the Royal Society of New South Wales, I beg to acknowledge the receipt of and I am directed to convey to you the best thanks of the Society for your most valuable donation.

I have the honor to be,

Sir,

Your most obedient servant,

Hon. Secretary.

Form No. 7.

Balloting List for the Election of the Officers and Council.

ROYAL SOCIETY OF NEW SOUTH WALES.

Date.......................

BALLOTING LIST for the election of the Officers and Council.

Present Council.	Names proposed as Members of the new Council.	
	President.	
	Vice-Presidents.	
	Hon. Treasurer.	
	Hon. Secretaries.	
	Members of Council.	

If you wish to substitute any other name in place of that proposed, erase the printed name in the second column, and write opposite to it, in the third, that which you wish to substitute.

LIST OF THE MEMBERS

OF THE

Royal Society of New South Wales.

P Members who have contributed papers which have been published in the Society's Transactions or Journal; papers published in the Transactions of the Philosophical Society are also included. The numerals indicate the number of such contributions.
† Members of the Council.
‡ Life Members.

Elected.		
1877		Abbott, Joseph Palmer, Murrurundi.
1877		Abbott, Thomas Kingsmill, P.M., Gunnedah.
1877		Abbott, W. E., Glengarry, Wingen.
1877		Adams, Francis, A.J.S. Bank, Sydney.
1864		Adams, P. F., Surveyor General, Kirribilli Point, St. Leonards.
1878		Alexander, George M., 48, Margaret-street.
1874		Alger, John, Macquarie-street.
1870		Allen, The Hon. Sir George Wigram, M.P., Speaker of the Legislative Assembly, 124, Elizabeth-street North.
1868		Allerding, F., Hunter-street.
1873		Allerding, H. R., Hunter-street.
1856		Allwood, Rev. Canon, B.A. *Cantab.*, Vice-Chancellor, University of Sydney, Woollahra.
1876		Alston, John Wilson, M.B. *Edin.*, Mast. Surg. *Edin.*, 455, Pitt-street.
1877		Anderson, A. W., Oriental Bank, Sydney.
1877		Anderson, H. C. L., M.A., Sydney Grammar School.
1879		Armstrong, Fred. J., Winthrop, Nelson-street, Woollahra.
1876		Armstrong, W. D., Surveyor General's Office.
1878		Archer, W. H., F.I.A., Australian Club.
1879		Arnheim, E. H., Royal Mint, Sydney.
1876		Atchison, Cunningham Archibald, C.E., North Shore.
1873		Atherton, Ebenezer, M.R.C.S. *Eng.*, O'Connell-street.
1873		Austen, Henry, Hunter-street.
1876		Backhouse, Benjamin, Ithaca, Elizabeth Bay.
1878		Backhouse, Alfred P., M.A., Ithaca, Elizabeth Bay.
1878		Balfour, James, Union Club.
1876	P 4	Barkas, Wm. James, Lic. R. Col. Phys. *Lond.*, M.R.C.S. *Eng.*, Warialda.
1878		Barker, Francis Lindsay, 180, Pitt-street.

Elected.		
1879		Barraclough, William, 2, Yurong-street.
1875		Bartels, W. C. W., Union Club.
1876		Bassett, W. F., M.R.C.S., *Eng.*, Bathurst.
1878		Bayley, George W. A., Railway Department, Phillip-street.
1875		Bedford, W. J. G., M.R.C.S. *Eng.*, Staff Surgeon.
1868		Beilby, E. T., Pitt-street.
1875		Belgrave, Thomas B., M.D. *Edin.*, M.R.C.S. *Eng.*, 153 Elizabeth-street.
1877		Belfield, Algernon H., Eversleigh, Armidale.
1875		Belisario, John, M.D., Lyons' Terrace.
1876		Benbow, Clement A., 24, College-street.
1869	P 2	Bensusan, S. L., Exchange, Pitt-street.
1877		Bennett, George F., C.M.Z.S., Toowoomba, Queensland.
1878		Berney, Augustus, H. M. Customs, Sydney.
1878		Bestic, Edwin Henry, L.R.C.S., *Irel.*, L.R.C.P., *Edin.*, Arthursleigh-terrace.
1878		Black, Reginald James, Bank of New South Wales, Sydney.
1878		Black, Morrice A., F.I.A., Actuary, Mutual Provident Society.
1877		Bladen, Thomas, Pyrmont.
1872		Bolding, H. J., P.M., Newcastle and Union Club.
1879		Bond, Albert, Bell's Chambers, Pitt-street.
1874		Bowen, George M. C., Keston, Kirribilli Point, North Shore.
1876		Brady, Andrew John, Lic. K. & Q. Coll. Phys. *Irel.*, Lic. R. Coll. Sur. *Irel.*, Lyons' Terrace.
1871	P 1	Brazier, John, C.M.Z.S., Corr. M.R.S., Tas., 11, Windmill-street.
1868		Brereton, John Le Gay, M.D. *St. Andrew's*, L.R.C.S. *Edin.*, Domain Terrace.
1879		Brindley, Thomas, Nepean Cottage, Bourke-street, Redfern.
1876		Bristowe, E. H. C., 3, Nobbs-street, Surry Hills.
1876		Brodribb, W. A., F.R.G.S., Double Bay.
1878		Brooks, Joseph, F.R.G.S., Hope Bank, Nelson-st., Woollahra.
1876		Brown, Henry Joseph, Newcastle.
1876		Brown, Thomas, Eskbank, Bowenfels, and Australian Club.
1877		Bundock, W. C., Australian Club.
1876		Burn, James Henry, 93, Palmer-street, Woolloomooloo.
1875		Burton, Edmund, Land Titles Office, Elizabeth-street North.
1877		Burnell, Arthur, Survey Office.
1878		Burnett, Robt. H., C.E., Railway Department.
1875		Busby, The Hon. William, M.L.C., Redleaf, South Head Road Woollahra.
1878		Butterfield, George, Survey Office.
1876		Cadell, Alfred, Vegetable Creek, New England.
1876		Cadell, Thomas, Wotonga, East St. Leonards.
1876		Campbell, Allan, L.R.C.P., *Glasgow*, Yass.
1876		Campbell, The Hon. Alexander, M.L.C., Woollahra.
1868		Campbell, The Hon. Charles, M.L.C., Clunes, South Kingston.
1872		Campbell, The Hon. John, M.L.C., Clunes, South Kingston.
1870		Cane, Alfred, Stanley-street.

Elected.		
1879		Cameron, John, surveyor, Barringun, *viâ* Bourke.
1879		Campbell, Joseph, St. Paul's College, Darlington.
1876		Cape, Alfred J., Torfrida, Elizabeth Bay.
1876		Chandler, Alfred, 185, Pitt-street.
1879		Chard, J. S., District Surveyor, Armidale.
1878		Chatfield, William, 69, Pitt-street.
1878		Chisholm, Edwin, M.D., M.R.C.S., L.S.A., &c., Ashfield.
1876	P 1	Christie, Wm., L.S., Hawthorn Lodge, Glen Innes.
1877		Clarke, William, E. S. & A. C. Bank, Pitt-street.
1874		Clay, William French, M.A., *Cantab.*, M.D. *Syd.*, M.R.C.S. *Eng.*, Fellow of St. Paul's Col., North Shore.
1876		Clune, Michael Joseph, M.A., Lic. K. & Q. Coll. Phys. *Irel.*, Lic. R. Coll. Sur. *Irel.*, 12, College-street.
1876		Codrington, John Fredk., M.R.C.S., E.; Lic. R.C. Phys., L.; Lic. R.C. Phys., *Edin.*, Orange.
1878		Collie, Revd. Robert, Newtown.
1878		Colquhoun, George, 3, Mona-terrace, Rushcutters' Bay.
1876		Colyer, John Ussher Cox, A.S.N. Company, Sydney.
1856		Comrie, James, Northfield, Kurrajong Heights.
1876		Conder, Wm., Survey Office, Sydney.
1874		Combes, Edward, M.L.A., Bathurst.
1878		Cottee, Wm. Alfred, Spring-street.
1859	P 1	Cox, James, M.D. *Edin.* C.M.Z.S., F.L.S., Hunter-street.
1865	P 2	†Cracknell, E. C., Superintendent of Telegraphs, Telegraph Office, George-street.
1869		Creed, J. Mildred, M.R.C.S. *Eng.*, Scone.
1870		Croudace, Thomas, Lambton.
1877		Cunningham, Andrew, Lanyon, Queanbeyan.
1873		Daintrey, Edwin, Æolia, Randwick.
1876		Dalgarno, John V., Telegraph Office, George-street.
1876		Dansey, George Frederick, M.R.C.S. *London*, Cleveland-street Redfern.
1875		Dangar, Frederick H., Greenknowes, Darlinghurst.
1876		Darley, Cecil West, Newcastle.
1877		Darley, F. M., M.A., Union Club, Sydney.
1879		Davenport, Samuel, Executive Commissioner for South Australia Garden Palace.
1878		Dean, Alexander, J.P., Elizabeth-street.
1877		Deck, John Field, M.D., 251, Macquarie-street.
1856		Deffell, George H., Bayfield, Woolwich Road, Hunter's Hill.
1878		De Lissa, S., 3, Barrack-street.
1875		De Salis, The Hon. Leopold Fane, M.L.C., Cuppercumbalong, Lanyon.
1875		De Salis, L. W., junr., Strathmore, Bowen, Queensland.
1873		Dibbs, George R., M.P., 131, Pitt-street.
1876		Dight, Arthur, Richmond.

Elected		
1876		Dixon Douglas, Australian Club.
1875	P 5	†Dixon, W. A., F.C.S., Fellow and Member Inst. of Chemistry of Gt. Britain and Irel., Lecturer on Chemistry, School of Arts; Chemical Laboratory, School of Arts, Sydney.
1876		Docker, Ernest, M.A. *Sydn.*, 134, Burton-street.
1879		Docker, Wilfred L. Craigstone, William-street South.
1876		Douglas, James, L.R.C.S. *Edin.*, Hope Terrace, Glebe Road.
1879		Dowling, Neville, Wallace-street, Woollahra.
1876		Drake, William Hedley, Colonial Bank of New Zealand, Nelson, N.Z.
1873		Du Faur, Eccleston, F.R.G.S., Lands Office.
1876		Eales, John, Duckenfield Park, Morpeth.
1876		Egan, Myles, M.R.C.S. *Eng.*, 2, Hyde Park Terrace, Liverpool-street.
1874		Eichler, Charles F., M.D. *Heidelberg*, M.R.C.S. *Eng.*, Bridge-street.
1876		Eldred, W. H., 119, Castlereagh-street.
1878		Ellis, Thomas Augustus, C.E., City Engineer, Newcastle.
1876		Evans, George, Como, Darling Point.
1876		Evans, Owen Spencer, M.R.C.S. *Eng.*, Darling-street, Balmain.
1877		Fache, Charles James, Cleveland House, Redfern.
1877		Fairfax, Edward R., 177, Macquarie-street.
1868		Fairfax, James R., *Herald* Office, Hunter-street.
1876		Firth, Rev. Frank, Wesleyan Parsonage, Waverley.
1874		Fischer, Carl F., M.D., F.L.S., Soc. Zool. Bot. Vindob. Socius., 251, Macquarie-street.
1876		Fitzgerald, R. D., F.L.S., Surveyor General's Office.
1856		Flavelle, John, George-street.
1863		Fortescue, G., M.B. *Lond.*, F.R.C.S., F.L.S., Lyons' Terrace.
1879		Foreman, Joseph, M.R.C.S. *Lond.*, L.R.C.P. *Edin.*, Lithgow.
1877		Fraser, A. C., 235, Albion-street.
1878		Fraser, Robert, 12, Barrack-street.
1875		Frazer, Hon. John, M.L.C., York-street.
1876		Freehill, Bernard Austin, 130, Elizabeth-street.
1878		Fry, Edward H., 5, Verena Terrace, Walker-street, Redfern.
1878		Fuller, Francis John, City Engineer's Office, Newcastle.

Elected.		
1879		Gabriel, C. Louis, care of Dr. J. J. Hill, Lambton.
1877		Garnsey, Rev. C. F., Christ Church Parsonage, Sydney.
1868	P 1	Garran, Andrew, LL.D. *Syd.*, *Herald* Office, Hunter-street.
1877		Garvan, J. P., East Leonards.
1879		Garvey, Rev. J. J., Woollahra.
1878		Gedye, Charles Townsend, Eastbourne, Darling Point.
1878		George, Hugh, *Sydney Morning Herald* Office.
1876		George, W. R, 360 George-street.
1879		Gerard, Francis, Occupation of Lands Office.
1878		Giblin, Vincent W., Australian Joint Stock Bank, Sydney.
1876		Gilchrist, W. O., Elizabeth Bay.
1875		Gilliat, Henry Alfred, Australian Club.
1876		Gillman, Thomas Henry, B.A., C.M., M.D., Queen's Univ. *Irel.*, Mast. Surg. Queen's Univ. *Irel.*, 1, Clarendon Terrace, Hyde Park.
1876		Gipps, F. B., 134, Pitt-street.
1878		Goddard, William C., The Exchange, New Pitt-street.
1859		Goodlet, John H., George-street.
1876		Goode, George, M.A., M.D., M. Ch., Trin. Coll., *Dub.*, Enfield House, Camden.
1876		Graham, Hon. Wm., M.L.C., Stratheam House, Waverley.
1873		Greaves, W. A. B., Armidale.
1878		Griffiths, Frederick C., Macquarie-street.
1877		Griffiths, G. Neville, The Domain, Sydney.
1875		Grundy, F. H., 183, Pitt-street.
1877		Gurney, T. T., M.A. *Cantab.*, late Fellow of St. John's College, Cambridge, Professor of Mathematics and Natural Philosophy, University of Sydney.
1864		Hale, Thomas, Gresham-street.
1878		Hall, Richard T., Benton, Barcom-street, Glenmore Road.
1874		Hardy, J., Hunter-street.
1877		Hargrave, Lawrence, 94, Upper William-street.
1877		Harrison, L. M., Macquarie Place.
1878	P 2	Hart, Ludovico, Government Printing Office.
1878		Haviland, E. Cyril, 7 Little George-street.
1877	P 1	Hawkins, H. S., M.A., Balmain.
1874		Hay, The Hon. Sir John, K.C.M.G., M.L.C., M.A. *Glasgow*, President of the Legislative Council, Rose Bay, Woollahra.
1876		Heaton, J. H., *Town and Country* Office, Pitt-street.
1875		Helsham, Douglass, York's Terrace, Glebe.
1877		Henry, James, 754, George-street.
1878		Herborn, E. W. L., Victoria-street, Darlinghurst.
1878		Herborn, Eugene, 318, Victoria-street, Darlinghurst.
1876		Heron, Henry, solicitor, 49, Hunter-street.
1878		Hewett, Thomas Edward, Observatory, Sydney.
1859		‡Hill, Edward S., C.M.Z.S., Rose Bay, Woollahra.
1879		Higgins, R. G., Clifford, Potts's Point.
1879		Hills, Robert, Elizabeth Bay.

Elected.		
1879		Hitchins, Edwd. Lytton, Florence, Victoria-street, Darlinghurst.
1877		Hindson, Lawrence, Careening Cove, North Shore.
1876	P 1	†Hirst, Geo. D., 379, George-street.
1878		Hodgson, Rev. E. G., M.A. *Oxon.*, S.C.L., Vice-Warden of St. Paul's College, University.
1868		Holt, The Hon. Thomas, M.L.C., The Warren, near Sydney.
1876		Holroyd, Arther Todd, M.B. *Cantab.*, M.D. *Edin.*, F.L.S., F.Z.S., F.R.G.S., Master-in-Equity, Sherwood Scrubs, Parramatta.
1870		Horton, Rev. Thomas, Ina Terrace, Woollahra.
1877		Hume, J. K., Cooma Cottage, Yass.
1878		†Hunt, Robert, F.G.S., Associate of the Royal School of Mines, London, Deputy Master of the Royal Mint, Sydney.
1879		Houison, Andrew, B.A., M.B.C.M., 128, Phillip-street.
1876		Icely, Thos. R., Carcoar.
1879		Inglis, James, Redmyre.
1877		Innes, Sir J. George L., Knt., Darlinghurst.
1878		Jackson, Arthur Levett, Government Printing Office.
1876		Jackson, Henry Willan, M.R.C.S. *Eng.*, Lic. R. C. Phys., *Edin.*, 130, Phillip-street.
1879		Jarvie, Rev. A. Milne, Univ. Council, *Edin.*, Scots' Church, Sydney.
1879		Jefferis, Rev. James, LL.B., The Retreat, Newtown.
1876		Jenkins, Richard Lewis, M.R.C.S., Nepean Towers, Douglass Park.
1874		Jennings, P. A., C.M.G., Edgecliffe Road, Woollahra.
1877		Jennings, W. E., B.A., Mining Department, Sydney.
1876		Jones, James Aberdeen, Lic. R.C. Phys. *Edin.*, Booth-street, Balmain.
1876		Jones, Richard Theophilus, M.D. *Sydn.*, L.R.C.P. *Edin.*, Ashfield.
1867		Jones, P. Sydney, M.D. *Lond.*, F.R.C.S. *Eng.*, College-street.
1877		Jones, Edward Lloyd, 345, George-street, Sydney.
1874		Jones, James, Bathurst-street.
1877		Jones, Griffith Evan Russell, B.A., *Syd.*, 382, Crown-street, Surry Hills.
1879		Jones, John Trevor, 356, Liverpool-street.
1879		Johnson, James W., Brooksby, Double Bay.
1863		Josephson, Joshua Frey, F.G.S., District Court Judge, Enmore Road, Newtown.
1876	P 1	Josephson, J. P., Assoc. Mem. Inst. C.E., 253, Macquarie-street North.
1878		Joubert, Numa, Noumea.

Elected.		
1873		Keele, Thos. Wm., Harbours and Rivers Department, Phillip-street.
1877		Keep, John, Broughton, Leichhardt.
1879		Kemmis, Rev. Thomas, St. Mark's Parsonage, Darling Point.
1873		Kennedy, Hugh, B.A. *Oxon.* Registrar of the Sydney University.
1874		King, Philip G., William-street, Double Bay.
1877		Kinloch, John, M.A., Hurlstone College, Ashfield.
1878		Knaggs, Saml. J., M.D., Newcastle.
1874		Knox, George, M.A., *Cantab.*, King-street.
1875		Knox, Edward, 24, Bridge-street.
1877		Knox, Edward, jun., Fiona, Double Bay.
1877		Kopsch, G., Telegraph Department.
1878		Kretschmann, Joseph; care of Mr. Moss, Hunter-street.
1878		Kyngdon, F. B., 221, Darlinghurst Road.
1878		Kyngdon, Fred. H., M.D. *Aberdeen*; L.S.A., *L.*; M.R.C.S., *E.*; C.M., *Aberdeen*, North Shore.
1876		Langley, W. E., *Herald* Office, Sydney.
1874	P 1	Latta, G. J., Hawthorne, Chrystal-street, Petersham.
1876		Laure, Louis Thos., M.D. Surg. Univ. *Paris*, 138, Castlereagh-street.
1859	P 5	†Leibius, Adolph, Ph. D., *Heidelberg*, F.C.S.; Fel. Inst. of Chemistry of Gt. Brit. and Irl.; Senior Assayer to the Sydney Branch of the Royal Mint, *Hon. Secretary.*
1874		Lenehan, Henry Alfred, Sydney Observatory.
1872	P 11	†Liversidge, Archibald, F.C.S.; Fel. Inst. Chemistry of Gt. Brit. and Irl.; F.G.S.; F.L.S.; F.R.G.S.; Assoc. Roy. Sch. Mines, *Lond.*; Mem. Phy. Soc. London; Mem. Mineralogical Soc. Gt. Brit. and Irel.; Cor. Mem. Roy. Soc. Tas.; Cor. Mem. Senckenberg Institute, Frankfurt; Cor. Mem. Soc. d'Acclimat. Mauritius; Hon. Fel. Roy. Hist. Soc. Lond.; Mem. Min. Soc. of France; Professor of Geology and Mineralogy in the University of Sydney, *Hon. Secretary*, Union Club.
1875		Living, John, Marsaloo, North Shore.
1874		Lloyd, George Alfred, F.R.G.S., Scottforth, Elizabeth Bay.
1879		Loftus, His Excellency The Right Hon. Lord Augustus, G.C.B., &c., &c., &c.
1876		Lord, The Hon. Francis, M.L.C., North Shore.
1877		Lord, George Lee, Kirketon, Darlington.
1878		Low, Hamilton, Lillington, South Kingston.

Elected.		
1876		M'Carthy, W. F., solicitor, Pitt-street.
1876		M'Culloch, A. H., jun., 165, Pitt-street.
1874		M'Cutcheon, John Warner, Assayer to the Sydney Branch of the Royal Mint.
1878		MacDonald, Ebenezer, Oriental Bank, Sydney.
1859		MacDonnell, William, George-street.
1868		MacDonnell, William J., F.R.A.S., George-street.
1877		MacDonnell, Samuel, 326, George-street, Sydney.
1876		M'Guire, W. H., Telegraph Office, George-street.
1876		M'Kay, Dr., Church Hill.
1878		‡MacPherson, Rev. Peter, M.A., 241, Carlingford Terrace, Albion-street, Sydney.
1872		Mackenzie, John, F.G.S., Examiner of Coal Fields, Newcastle.
1874		Mackenzie, W. F., M.R.C.S., *Eng.*, Lyons' Terrace.
1876		Mackenzie, Rev. P. F., Friendville, Paddington.
1876		Mackellar, Chas. Kinnard, M.B., C.M., *Glas.*, Lyons' Terrace.
1876		Maclaurin, Henry Norman, M.A., M.D. Univ. *Edin.*, Lic. R. Coll. Sur. *Edin.*, 187, Macquarie-street.
1878		Maitland, Duncan Mearns, junior, Elizabeth-street, Paddington.
1873		Makin, G. E., Berrima.
1878		Mallarky, Stephen, Government Printing Office.
1877		Mann, John, Neutral Bay.
1873	P 5	Manning, James, Milson's Point, North Shore.
1876		Manning, Frederick Norton, M.D. Univ. *St. And.*, M.R.C.S. *Eng.*, Lic. Soc. Apoth. *Lond.*, Gladesville.
1869		Mansfield, G.A., Pitt-street.
1878		Markey, James, L.R.C.S., *Irel.*, L.R.C. Phys., *Edin.*, Regent-street.
1878		Marklove, Robert J., 52, Pitt-street.
1872		Marsden, The Right Rev. Dr., Bishop of Bathurst, Bathurst.
1876		Marsh, J. M., Edgecliff Road, Woollahra.
1876		Marshall, George, M.D. Univ. *Glas.*, Lic. R. Coll. S. *Edin.*, Lyons' Terrace.
1876		Martin, Rev. George, Princes-street.
1879		Masters, Edward, Lurlei, Marrickville.
1875		Mathews, R. H., Mundooran.
1879		Matthews, Robert, Tumut-street, Adelong.
1878		Meilhan, Jules, Victoria Terrace, Victoria-street.
1877		Merriman, James, Pitt-street.
1879		Meslée, E. Marin de la, Surveyor General's Office.
1868		Metcalfe, Michael, Bridge-street.
1873		Milford, F., M.D. *Heidelberg*, M.R.C.S. *Eng.*, 3, Clarendon Terrace, Hyde Park.
1876		Milford, S. F. F., Lands Office.
1876		Millard, Rev. Henry Shaw, Newcastle Grammar School.
1875		Moir, James, Margaret-street.
1875		†Montefiore, E. L., Macleay-street.
1878		Montefiore, Octavius L., Belgian Consul, Gresham-street.
1856	P 2	†Moore, Charles, F.L.S., Director of the Botanic Gardens, Botanic Gardens, *Vice-President*.
1879		Moore, Fred. H., Exchange Buildings.
		Morehead, R. A. A., 30, O'Connell-street.
1872		Morgan, Cosby William, M.D. *Brussels*, L.R.C.P. *Lond.*, 137, Castlereagh-street.

Elected.		
1876		Morgan, Allan Bradley, M.R.C.S. *Eng.*, Lic. Mid. Lic. R. Coll Phys. *Edin.*, Ashenhurst, Burwood.
1876		Morgan, T. C., L.R.C.S. *Edin.*, M.K. & Q. Coll. Phys. *Ireland*, 137, Castlereagh-street.
1865	P 1	Morrell, G. A., C.E., Pitt-street.
1877		Morris, William, F.F.P.S. *Glas.* & F.R.M.S.L., 5, Carlton Terrace, Wynyard Square, Sydney.
1879		Mountain, Adrian C., City Surveyor, Town Hall.
1877		‡Mullens, Josiah, F.R.G.S., 34, Hunter-street.
1879		Mullins, John, F.L., M.A., 233, Macquarie-street.
1865		Murnin, M. E., Eisenfels, Nattai.
1876		Murray, W. G., 52, Pitt-street.
1876		Myles, Chas. Henry, Wymela, Burwood.
1876		Neild, John Cash, M.D. & C.D., *Berlin*, M.R.C.S. *Eng.*, Lic. Soc. Apoth. *Lond.*, Elizabeth-street, Sydney.
1873		Neill, William, City Bank, Pitt-street.
1879		Neill, W. J. Walter, City Bank, Pitt-street.
1874		Neill, A. L. P., City Bank, Pitt-street.
1879		Newman, W., care of Messrs. David Jones & Co., George-street.
1878		Newton, John, Darling Point.
1874		Nichol, D., 12 Barrack-street.
1876		Nilson, Aroid, Department of Mines.
1873		Norton, James, solicitor, Elizabeth-street.
1875		Nott, Thomas, M.D. *Aberdeen*, M.R.C.S. *Eng.*, Ocean-street, Woollahra.
1878		Nowlan, John, Union Club and West Maitland.
1879		O'Connor, Dr. Maurice, 80, William-street.
1878		Ogilvy, James L.,Oriental Bank, Sydney.
1877		Olley, Rev. Jacob, Manly.
1875		O'Reilly, W. W. J., M.D., M.C., Q. Univ. *Irel.*, M.R.C.S., *Eng.*, Liverpool-street.

Elected		
1875		Palmer, J. H., Legislative Assembly.
1876		Parrott, Thomas S., C.E., Ashfield.
1861		Paterson, Hugh, Macquarie-street.
1878		Paterson, Hugh, junr., 247, Macquarie-street.
1877		Paterson, James A., Union Bank, Pitt-street.
1878		Paterson, Alexander, M.D., M.A., Hillcrest, Stanmore Road.
1877		Pedley, Perceval R., 48, Wynyard Square.
1877		Perkins, Henry A., Pembrook, Johnson-street, Balmain.
1856		Phillip, H., Pacific Insurance Company.
1876		Pickburn, Thomas, M.D. *Aberdeen*, Ch. M., M.R.C.S. *Eng*., 40, College-street.
1879		Pittman, Edwd. Fisher, L.S., Department of Mines.
1879		Pockley, Thos. F. G., Commercial Bank, Goulburn.
1878		Poolman, F., Colonial Sugar Refining Co., Bridge-street.
1878		Potts, J. H., Victoria-street, Ashfield.
1862		Prince, Henry, George-street.
1876		Quaife, Fredk. Harrison, M.D., Mast. Surg. Univ. *Glas*., Hughenden, Queen-street, Woollahra.
1876		Quirk, Rev. Dr. J. A., O.S.B., LL.D., *Syd*., St. Joseph's, Newtown.
1878		Quirk, Rev. D. Placid, M.A. (Syd. Univ.), Post Office, Cook's River.
1876		Quodling, W. H., Burwood.
1865	P 1	‡Ramsay, Edward, F.L.S., Curator of the Australian Museum, College-street.
1876		‡Ratte, F., Noumea, New Caledonia.
1878		Read, George H., Secretary to the Attorney General.
1874		Read, Reginald Bligh, M.R.C.S., *Eng*., Paddington.
1877		Read, Richard, M.D., Singleton.
1868		Reading, E., Mem. Odont. Soc. *Lond*., Castlereagh-street.
1876		Reece, J. D., Surveyor General's Office.
1870		Renwick, Arthur, M.D. *Edin*., B.A., *Sydn*., F.R.C.S. *E*., 295, Elizabeth-street.
1856		Roberts, J., George-street.
1868	P 3	Roberts, Alfred, M.R.C.S. *Eng*., Hon. Mem. Zool. and Bot. Soc. Vienna, Bridge-street.
1878		Roberts, William, Australian Club.
1871		Robertson, Thomas, solicitor, 91 Pitt-street.
1873		Rogers, Rev. Edward, Rural Dean, Fort-street.
1856	P 6	†Rolleston, Christopher, C.M.G., Auditor General, Castlereagh-street.

Elected.		
1878		Rose, W., Union Club.
1865		Ross, J. Grafton, 24, Bridge-street.
1876		Rowling, Dr., Mudgee.
1864	P 16	†Russell, Henry C., B.A., *Syd.*, F.R.A.S., F.M.S., Hon. Mem. S. Aust. Inst., Government Astronomer, Sydney Observatory.
1875		Sahl, Charles L., German Consul, Consulate of the German Empire, Wynyard Square.
1876		Saliniere, Rev. E. M., Glebe.
1876		Samuel, The Hon. Saul, C.M.G., M.L.C., Gresham-street.
1876		Schuette, Rudolf, M.D., Univ. *Göttingen*, Lic. Soc. Apoth. *Lond.*, 10, College-street.
1856	P 1	‡Scott, Rev. William, M.A. *Cantab.*, Hon. Mem. Roy. Soc. Vic., The Parsonage, Queanbeyan.
1876		Scott, A.W., M.A. *Cantab.*, Ferndale, South Head Road.
1876		Sedgwick, Wm. Gillett, M.R.C.S., *Eng.*, Newtown.
1877		Selfe, Norman, C.E., Rockleigh, Balmain.
1876		Sharp, James Burleigh, J.P., Clifton Wood, Yass.
1876		Sharp, Henry, Green Hills, Adelong.
1878	P 1	Sharp, Revd. W. Hey, M.A. *Oxon.*, Warden of St. Paul's College, University.
1879		Shepard, A.D., Adelong.
1875		Sheppard, Rev. G., B.A., Berrima.
1878		Skinner, J. H., B.A. *Oxon.*, Grammar School, Sydney.
1875		Slade, G. P., solicitor, Bridge-street.
1877		Slattery, Thomas, Premier Terrace, 169, William-street, Woolloomooloo.
1872		Sleep, John S., 139, Pitt-street.
1877		Sloper, Fredk. Evans, 360, Liverpool-street.
1852	P 5	†Smith, John, The Hon., C.M.G., M.D., LL.D., *Aberdeen*, M.L.C., F.C.S., Hon. Mem. Roy. Soc. Vic., Professor of Physics and Chemistry in the University of Sydney, 193, Macquarie-street, *Vice-President*.
1878	P 1	Smith, Marshall, Glanville-street, Glanville, South Australia.
1875		Smith, Robt., M.A. *Syd.*, Solicitor, Sydney.
1874		Smith, John M'Garvie, Hunter-street.
1876		Smith, R. S., Surveyor General's Office.
1878		Smith, E. E., Fevereaux, Roslyn-street, Upper William-street, North.
1876		Southey, H. E., Oaklands, Mittagong.
1879		Spry, James Monsell, Union Club.
1872	P 1	Stephen, George Milner, B.A., F.G.S., Mem. Geol. Soc. of Germany; Cor. Mem. Nat. Hist. Soc., Dresden; F.R.G.S. of Cornwall; 3 Cambridge Terrace, Newtown Road.
1879		Stephen, Septimus, South Kingston.
1879		Stephen, Alfred F. H., 3, Cambridge Terrace, Newtown Road
1857		Stephens, William John, M.A. *Oxon.*, 233, Darlinghurst Road.
1876		Stopps, Arthur J., Surveyor General's Office.

Elected		
1878		Street, John Rendell, Birtley, Elizabeth Bay Road.
1876		Strong, Wm. Edmund, M.D., *Aberdeen*, M.R.C.S., *Eng.*, Liverpool.
1874		Stuart, Alexander, M.L.A., Sydney.
1876		Stuart, Clarendon, Upper William Street South.
1876		Suttor, Wm. Henry, M.L.A., Cangoura, Bathurst.
1879		Tarrant, Harman, M.R.C.S., Elizabeth-street.
1874		Taylor, Chas., M.D. *Syd.*, M.R.C.S., *Eng.*, Parramatta.
1879		Taylor, Chas. Lamb, M.R.C.S., 14, College-street.
1876		Tayler, William George, F.R.C.S., *Lond.*, 219, Pitt-street.
1862	P 6	Tebbutt, John, F.R.A.S., Observatory, Windsor.
1878		Tennant, E. G., M.R.C.S., Bourke-street, Dubbo.
1879		Thomson, Dugald, 20, Charlotte Place.
1870	P 1	Thompson, H. A., O'Connell-street.
1875		Thompson, Joseph, Bellevue Hill, Double Bay.
1877		Thompson, Thos. James, Pitt-street, Sydney.
1876		Thomas, H. Arding, Narellan.
1878		Thomas, F. J., Hunter River N.S.N. Co., Market-street.
1876		Thomas, Wm. Smith, M.R.C.S., *Eng.*, Wollongong.
1876		Tibbits, Walter Hugh, M.R.C.S., *Eng.*, Dubbo.
1876		Toohey, J. T., Melrose Cottage, Cleveland-street.
1873		Trebeck, Prosper N., George-street.
1879		Trebeck, P. C., George and Margaret Streets.
1876		Trouton, F. H., A.S.N. Company's Offices, Sydney.
1877		Tucker, G. A., Ph. D., Superintendent, Bay View Asylum, Cook's River.
1868		Tucker, William, Clifton, North Shore.
1875		Tulloh, W. H., Margaret-street.
1875		Turner, G., 3 Fitzroy Terrace, Pitt-street, Redfern.
1874		Vessey, Leonard A., Survey Office.
1876		Voss, Houlton H., Goulburn.

Elected		
1879		Walker, H. O., Australian General Assurance Co., 129, Pitt-street.
1867		Walker, Philip B., Telegraph Office, George-street.
1870		Wallis, William, Moncur Lodge, Potts' Point.
1867		Ward, R. D., M.R.C.S. *Eng.*, North Shore.
1877		Warren, William Edward, M.D., M.R.C.S., 281, Elizabeth street, Sydney.
1876		Waterhouse, J., M.A. *Syd.*, Perkin-street, Newcastle.
1876		Watkins, John Leo, B.A. *Cantab.*, M.A. *Syd.*, Randwick.
1876		Watson, C. Russell, M.R.C.S., *Eng.*, Camden Terrace, Newtown.
1877		Watt, Alfred Joseph, Ashfield, Parramatta Road.
1859		Watt, Charles, New Pitt-street.
1876		Waugh, Isaac, M.B., M.C., *T.C.D.*, Parramatta.
1876		Webster, A. S., Union Club.
1867		Weigall, Albert Bythesea, B.A. *Oxon.*, M.A. *Syd.*, Head Master of the Sydney Grammar School, College-street.
1878		Welch, Edward Wm., St. Olives, Bondi.
1878		Westgarth, G. C., solicitor, Pitt-street.
1877		Weston, W. J., Union Club.
1879		Whitfield, Lewis, B.A. (Sydney Univ.), Grammar School.
1874		White, Rev. James S., M.A., LL.D., *Syd.*, Gowrie, Singleton.
1875		White, Hon. James, M.L.C., Cranbrook, Double Bay.
1877		White, Rev. W. Moore, A.M., LL.D., T.C.D., 1, Lawrening Terrace, Elizabeth-street.
1879		Wilshire, F. R., P.M., Berrima.
1879		Wilson, F. A. A., Alfred-street, St. Leonards.
1876		Windeyer, W. C., M.A., *Syd.*, M.L.A., King-street.
1876		Wise, George Foster, Immigration Office, Hyde Park.
1874	P 1	Wilkinson, C. S., F.G.S., Government Geologist, Department of Mines.
1876		Wilkinson, Henry Toller, Department of Mines.
1878		Wilkinson, Rev. Samuel, 5, Argyle Terrace, Pitt-street, Redfern.
1878		Wilshire, James Thompson, C.P.S., Scone.
1876		Williams, Percy Edward, Treasury.
1878		Wise, Henry, Savings' Bank, Barrack-street.
1873		Wood, Harrie, Under Secretary for Mines, Department of Mines.
1879		Woodhouse, E. B., Mount Gilead, Campbelltown.
1877		Woods, T. A. Tenison-, Phillip-street, Sydney.
1876		Woolrych, F. B. W., 107, William-street.
1872		†Wright, Horatio G. A., M.R.C.S., *Eng.*, Wynyard Square, *Hon. Treasurer.*
1878		Wright, Rev. Edwin H., St. Stephen's, Bourke.
1879		Young, John, Town Hall, George-street.
1878		Young, Lamont, H. G., Assoc. R. S. Mines, F.G.S., Oaklands, Mittagong.

Honorary Members.

Limited to Twenty.

Elected.		
1875		Agnew, Dr., Hon. Secretary, Royal Society of Tasmania, Hobart Town.
1875		Barlee, The Hon. F., late Colonial Secretary of Western Australia.
1875		Bernays, Lewis A., F.L.S., Vice-President of the Queensland Acclimatization Society, Brisbane.
1875		Ellery, Robert F., F.R.S., F.R.A.S., Government Astronomer of Victoria, Melbourne.
1875		Gregory, Augustus Charles, F.R.G.S., Surveyor General of Queensland, Brisbane.
1875		Haast, Dr. Julius von, Ph. D., F.R.S., F.G.S., Government Geologist and Director of the Canterbury Museum, New Zealand.
1875	P 1	Hector, James, C.M.G., M.D., F.R.S., Director of the Colonial Museum and Geological Survey of New Zealand, Wellington.
1875		M'Coy, Frederick, F.G.S., Hon. F.C.P.S., C.M.Z.S., Professor of Natural Science in the Melbourne University, Government Palæontologist, and Director of the National Museum, Melbourne.
1875	P 1	Müller, Baron Ferdinand von, K.C.M.G., M.D., Ph. D., F.R.S., F.L.S., Government Botanist, Melbourne.
1875		Schomburgh, Dr., Director of the Botanic Gardens, Adelaide, South Australia.
1875		Waterhouse, F. G., F.G.S., C.M.Z.S., Curator of the Museum, Adelaide, South Australia.
1875	P 9	Woods, Rev. Julian E. Tenison-, F.G.S., Hon. Mem. Roy. Soc., Victoria, Hon. Mem. Roy. Soc., Tasmania, Hon. Mem. Adelaide Phil. Soc., Hon. Mem. Linnean Soc., &c., Union Club, Sydney.
1876	P 1	Cockle, His Honor Sir James, Chief Justice, M.A., F.R.S., Brisbane, Queensland.
1876		De Köninck, Prof., M.D., Liège, Belgium.
1878		Walker, Thomas, Yaralla, Concord.
1879		Bentham, George, F.R.S., V.P.L.S., C.M.G., The Royal Gardens, Kew.
1879		Darwin, Dr. Charles, F.R.S., M.A., F.G.S., F.L.S., &c., &c., Beckenham, Kent.
1879		Huxley, Professor, F.R.S., LL.D., F.G.S., F.Z.S., F.L.S., &c., &c., Professor of Natural History in the Royal School of Mines, South Kensington, London.
1879		Owen, Professor C. B., M.D., D.C.L., LL.D., F.L.S., F.G.S., V.P.Z.S., &c., &c., The British Museum, London, W.C.

Corresponding Member.

1879	P 1	Etheridge, Robert, junr., F.G.S., &c., The British Museum.

Obituary, 1879.

1858		Bradridge, Thomas H.
1875		Owen, Hon. Robert, M.L.C.

ANNIVERSARY ADDRESS.

By the HON. PROFESSOR SMITH, C.M.G., Vice-President.

[*Delivered to the Royal Society of N.S.W.*, 28 *May*, 1879.]

GENTLEMEN,

In opening the business of the Society for another year I have the pleasure of congratulating the members on its continued prosperity, both as regards accessions to their numbers and appropriate work accomplished. We began last year with a muster-roll of 347, and during the year we elected seventy-eight new members. But six members died, and fifteen resigned, so that we begin the present year with a roll of 404. In addition to these we have fifteen honorary members, of whom one was elected last year, Thomas Walker, Esq., Yaralla, Concord, in appreciation of his timely and munificent donation of £500 in aid of the building fund.

The attendance at the usual monthly meetings has been very good; but if in connection with this I might venture to point out a failing that needs amendment, it is that while we have plenty of listeners at our meetings, we have scarcely enough instructors. It would gratify the Council of the Society if more of our members would take up special lines of research, and communicate their results from time to time in the shape of papers for our monthly meetings. I am aware that most of our members are busy people, each having plenty of daily cares and duties, and that "learned leisure" is a scarce commodity amongst us; and therefore perhaps the contributions to the Society are as numerous as might fairly be expected. I may call attention also to the fact that the work

of the Society is by no means adequately represented by the monthly papers. The various Sections that were formed two or three years ago continue in a state of healthy vitality, and in a quiet way they strive to enlarge the borders of our knowledge.

At the monthly meetings twelve papers were read, besides the anniversary address by Mr. Rolleston, Vice-President. Of the twelve papers—three were from the Rev. J. E. Tenison-Woods, on Timber-producing Forests of Tasmania, Molluscan Fauna of Tasmania, and some new Australian Miocene Corals; three were from Mr. Dixon, on the Metallurgy of Nickel and Cobalt, Deep Well Waters of Sydney, and Notes on Huan Island Guano; two from Mr. Russell, on Storms on the Coast of New South Wales, and Some Results of an Astronomical Experiment on the Blue Mountains; one from Mr. Tebbutt, on a proposed Correction to the Assumed Longitude of the Sydney Observatory; one from Captain Marshall Smith, on the Meteorology of the Coast of New South Wales; one from Mr. Hart, on the Rise and Progress of Photography; and one from Mr. J. P. Josephson, on Some Facts about the Great Tidal Wave of May, 1877.

At the sectional meetings numerous papers were read, and specimens and instruments exhibited and discussed. Section F (Geography and Ethnology) held no meetings during the year, but it has commenced operations this year, with fair prospect of doing good work. Two or three Sections have sent in no detailed report of their labours, and it is to be hoped that their Secretaries will kindly keep in view the desirability of preparing such reports at the end of each year, so that the whole work of the Royal Society may be adequately recorded.

The donations to the Society last year were numerous and valuable, numbering nearly 700, from different parts of the world. They consisted chiefly of books from Governments, learned Societies, and private individuals; but special mention ought to be made of a well got up and most useful collection of shells, including over 200 species, presented by Mr. John Brazier, a member of the Society; and also of some very fine specimens of fossil leaves

from the miocene tertiary beds at Dalton, near Gunning, together with a collection of silurian fossils from the beds near Yass, recently presented by another member of the Society, Mr. J. K. Hume, of Yass. It is interesting to note that miocene leaf beds have been found in the northern hemisphere as far north as latitude 79°. The plants founds in these beds, according to Professor Heer, indicate that a tropical or sub-tropical climate prevailed during the miocene period within the present Arctic regions.

The building in which we meet being now the property of the Society (the purchase having been completed last year) the Council has been able to fit up a small room as a Library, which already has been a great convenience to members; and we hope to make suitable arrangements for the preservation and due exposition of specimens and instruments; in fact, to make a commencement of a philosophical museum, useful and instructive to the members. This, however, requires more money, and will in time require more space than the present building affords. As the property now held by the Society is of considerable and increasing value, the Council has had under its consideration the propriety of getting the Society incorporated by an Act of our Legislature. In the meantime the building has been vested in Trustees.

Last year the Society was deprived of the highly esteemed services of one of the Honorary Secretaries, Professor Liversidge; but during his absence in Europe he was not unmindful of us, and to his attention we are indebted for the purchase of a number of valuable books and an excellent microscope. He also exerted himself to make our Society more widely known, and to open up friendly communications with other kindred Institutions. To-night we have the pleasure of welcoming him again amongst us. But now we have to regret the loss—temporary only I trust—of the other Honorary Secretary, Dr. Leibius, who, after twenty-two years' absence, has gone to revisit his native country. I am sure that the best wishes of the Society follow him. And here I must call your attention to the debt of gratitude the Society owes to both of these gentlemen, who now for four years have filled the arduous and

anxious post of Honorary Secretaries. The success of a Society like ours depends greatly on the judgment, zeal, and assiduity of its Secretaries, and the gentlemen named have never spared time or trouble in their efforts to advance our common interests.

This notice of services rendered brings me naturally to allude to the great loss the Society sustained last year in the removal by death of our honoured Vice-President, the Rev. William Branwhite Clarke, one of the fathers of the Society, and always its firm friend and active supporter. When the old Philosophical Society was re-organized in 1866 and converted into the Royal Society, Mr. Clarke, because of his acknowledged eminence as a geologist and of his scientific services to the Colony, was elected one of the first Vice-Presidents (the other being the Hon. Edward Deas-Thomson, C.B., afterwards K.C.M.G.), and was re-elected every year to the same office. I may remind the members that, by our constitution, the office of President is not elective, but is held by the Governor for the time being, so that it was not open to the members to raise Mr. Clarke to the higher honour.

I regret that I am not qualified to be Mr. Clarke's biographer; for, although I enjoyed his friendship for a quarter of a century, I have not been sufficiently conversant with his favourite studies, or with the modes and results of his investigations, to enable me to present a fitting picture of his life and labours. But as it is customary in Societies like this to place upon the official records a biographical notice of any member who may have taken a leading part in the business of the Society, or in furthering its objects, it becomes my duty now to perform this service as a tribute to the memory of our departed friend.

The Rev. W. B. Clarke was born 2nd June, 1798, in the county of Suffolk, England. After the usual preliminary education, he entered the University of Cambridge in 1817, and in due course took its degrees of B.A. and M.A. A taste for geology seems to have been early developed, and while at Cambridge he attended the lectures of Professor Sedgwick and Dr. E. Clarke. In 1821 he took holy orders, and after a time he was fortunate in obtaining

a curacy in his native parish under such circumstances as gave him favourable opportunities for travelling and carrying on geological explorations both in England and on the Continent. He was present at the siege of Antwerp in 1831, and soon after that he obtained a small living in England, with a promise of a rectory in Gloucestershire, to which, however, he was never inducted, as before it fell vacant he had sailed for Australia.

Mr. Clarke was induced to come out to this country partly to get the benefit of a warmer climate in seeking to shake off the effects of a severe attack of rheumatic fever, and partly to exercise his geological knowledge and tastes in a new and comparatively untrodden field. On arriving in Sydney in 1839, Bishop Broughton placed him in charge of King's School, Parramatta, where he remained about two years, and then betook himself entirely to clerical labours in the country. In 1844 the foundation stone of the church of St. Thomas, North Shore, was laid, and as soon as the building was completed Mr. Clarke commenced his ministrations there, and continued until 1870, when he resigned his charge in consequence of advancing years and failing health.

In addition to his clerical duties, Mr. Clarke held various honorary appointments. He was a Fellow of St. Paul's College, from its incorporation in 1853; also a Trustee of the Australian Museum, and of the Free Public Library. He was offered a seat on the first Senate of the University of Sydney in 1850, but in consequence of the hostility of Bishop Broughton to the constitution of the University, the offer had to be declined, and no clergyman of the Church of England appeared on the first Senate. At a later period he was offered the position of Professor of Geology in the University, but the Senate being at that time very short of funds, were unable to propose such terms as Mr. Clarke could see his way to accept.

Mr. Clarke was a Member or Fellow of numerous learned Societies, both in England and in other countries; such as the Geological, the Royal Geographical, and the Royal Society of Literature, in England; the Geological Society of France, the

Royal Geological Institute of Austria, and others of like character; and in 1876 he was elected a Fellow of the Royal Society of England, being one of the very few Australian colonists who have received that honour. It is also noticeable that he was elected soon after being first proposed, a rare circumstance, as there are always many more candidates than vacancies, and some have to wait a number of years. In 1876 there were fifty candidates, and only fifteen elected.

In regard to Mr. Clarke's connection with our own Society and those that preceded it, I find that the original "Philosophical Society of Australasia," instituted in 1821, had speedily fallen into abeyance, and it was not till 1850 that it was resuscitated under the title of the "Australian Philosophical Society," of which Mr. Clarke was a member of the first Council. This also died out, but reappeared again in 1856 as the "Philosophical Society of New South Wales," under the presidency of Sir W. Denison. Ten years thereafter the name was changed to "Royal Society of New South Wales," Sir John Young being the first President, and Mr. Clarke (as I have already stated) being one of the first Vice-Presidents. Mr. Clarke was all along a steady supporter of our Society. He attended the meetings of the Council and the monthly meetings of the members with great regularity, so long as his health permitted, and he was a frequent contributor of papers, besides delivering seven of the Vice-Presidential Addresses with which we are in the habit of beginning our annual campaign. The following are the titles of his more important papers:—"On the Transmutation of Rocks in Australasia;" "On the Auriferous and other Metalliferous Districts of Northern Queensland;" "On the Causes and Phenomena of Earthquakes;" "Notes on Deep Sea Soundings;" "Effect of Forest Vegetation on Climate."

In the address which Mr. Clarke delivered in 1867 to inaugurate the Royal Society, he gave an account of the Societies that had preceded it, defined its aims and objects, justified its new title, and advised the members as to their future line of action. A paragraph

from the conclusion of that address I am tempted to reproduce here, as it has perennial force and value, and few that listen to me now had an opportunity then of hearing it from Mr. Clarke's lips. "We must strive to discern clearly, understand fully, and report faithfully; to love truth in things physical as in things moral; to abjure hasty theories and unsupported conjectures; where we are in doubt, not to be positive; to give our brother observer the same measure of credit we take to ourselves; not striving for mastery, but leaving time for the formation of the judgment which will inevitably be given, whether for or against us, by those who come after; contented if we are able to add but one grain to that enduring pyramid which is now in course of erection as the testimony of Nature to the truth of Revelation."

In the last anniversary address which he delivered (17th May, 1876) he returned again to the objects and designs of the Society, and urged upon the members the desirability of obtaining a charter, of collecting a library of scientific works, of obtaining a permanent home for the Society, and above all, of each individual member taking up some line of research and adding his mite to the common store of knowledge. "We are called, no doubt," he says, "by a somewhat lofty designation, but we do not presume to consider ourselves of such renown as to make it presumption in any one to do what he can to help on the common work. Our true position is that of pioneers, sowers, foundation-layers, and in that respect we have assuredly an honorable occupation: and as such, and such only, I have aspired to take a part, somewhat perchance too prominent, in occasionally "going ahead," sometimes scattering a seed for thought here and there, and sometimes adding a pebble to what hereafter will, I hope, see itself surmounted by a superstructure of enduring reputation when you and I shall have long passed away beyond the heats of controversy or the coldness of criticism. Let us do what we can to serve honestly our day and generation, and then we may be assured that posterity, in its own time, will do us justice. May I be permitted to add that, to myself, it has been a great satisfaction

to have contributed in what I know to be a humble way to the Society's work. * * * * * Such care as I have been enabled to bestow upon it has been amply rewarded by the kind co-operation of my friends in the Council during the many years in which you have been pleased to place and keep me in a responsible position, and by an unexpected and general act of attention and regard not long since, which I should be wanting in duty and respect towards you if I did not thus publicly acknowledge. [He refers here to his portrait, which had been painted for the Society.] If all that remains of me at any future anniversary be the painted canvas, which does so much credit to the artist whom you voluntarily employed to do me honour, I still hope that that representation of me may look down upon a flourishing association of men, whose appearance at your meetings will not be the mere inducement to spend a pleasant evening, but who will find that even such a gathering is to be a pledge that they have at heart a better aim, and a more useful and nobler object for the employment of their leisure." These last words of advice will, I am sure, be cherished, and these last aspirations will find a responsive echo in the hearts of all who hear me.

Mr. Clarke was a fluent and prolific writer, and his contributions to scientific Societies and periodicals, and to the newspaper Press were very numerous, over and above his many official reports to Government and an extensive private correspondence. This correspondence must at times have been burdensome, for he was continually being applied to by diggers and amateur geologists for advice as to their pursuits, and for the identification of mineral specimens; and his readiness to aid all such to the best of his ability, regardless of the time and trouble involved, earned the gratitude of many, and a widespread popularity among the mining and exploring sections of the community.

Seven years ago there was published in the *Sydney Mail* a list of over 180 scientific papers by Mr. Clarke, chiefly on subjects connected with geology, mineralogy, meteorology, and other branches of Natural History, and the list was said to be far from

complete. Since that time a number of additional contributions have been given to the world. In addition to his scientific writings and the literary work connected with his ecclesiastical functions, Mr. Clarke published, before emigrating to Australia, two or three volumes of poems; and from time to time in this country he indulged his taste in verses, although he did not again collect them so as to put forth a book.

Considering the great number of separate papers which issued from Mr. Clarke's busy brain and pen, it is somewhat remarkable that he did not, except to a limited extent, seek to collect and condense his vast stores of information into convenient volumes for scientific libraries. It is probable that want of means in addition to want of leisure was the chief cause of this apparent neglect; but whatever the cause the fact is to be regretted, for the difficulty of referring to papers scattered over many periodicals and many years is such that practically they drop into oblivion, and it is difficult now to form a just conception of Mr. Clarke's enormous labours. On two subjects, however, Mr. Clarke collected his observations into books—the first, published in 1860, entitled "Researches in the Southern Gold-fields of New South Wales," and the second, entitled "Remarks on the Sedimentary Formations of New South Wales," a fourth edition of which was completed a fortnight before his death.

The portion of Mr. Clarke's geological labours most closely connected with the prosperity and advancement of the Colony is doubtless that relating to the discovery of gold and indication of gold-fields. Although other names may be associated with his—for example, Count Strzelecki and Sir Roderick Murchison on the scientific side, and Mr. Hargraves on the practical side—yet, after looking carefully through the available evidence scattered over a variety of publications, I have no hesitation in saying that Mr. Clarke deserves the chief credit as the discoverer of gold in Australia. As far back as February, 1841, he found gold near Hartley, apparently about the same place where Strzelecki had found an auriferous sulphide of iron in 1839, although of this

prior find Mr. Clarke does not seem to have been at the time of his own discovery aware. In 1842 he found gold on the Wollondilly. There is abundant evidence that from 1841 onwards Mr. Clarke frequently, in letters and in conversations, expressed his conviction that the Colony was rich in gold. Still he maintained a certain amount of reserve on the subject, and fearing the possible evil effects on colonial society, he refrained from publishing his views to the world. In April, 1844, however, he communicated his opinions to the Governor, Sir George Gipps, and showed him specimens of the gold, but was advised by him to "put it away," as it would lead to dangerous consequences. In the early part of 1844 Mr. Clarke announced the existence of gold to the north of the Liverpool Dividing Range; and in 1845 he obtained gold in several places in the Bathurst district.

It was in 1844 that Sir Roderick Murchison, having just returned from an exploration of the Ural Mountains, had an opportunity of examining the geological collection brought from Australia by Count Strzelecki. "Seeing" (he observes in *Siluria*), "the great similarity of the rocks in the two distant countries, I had little difficulty in drawing a parallel between them; in doing which I was naturally struck by the circumstance that no gold had yet been found in the meridional Australian ridge, which I termed, in anticipation, the Cordillera." In 1846 he wrote to the President of the Royal Geological Society of Cornwall, at its anniversary meeting, and "incited the superabundant Cornish tin-miners to emigrate to the Colony of New South Wales, and there obtain gold from ancient alluvia in the same manner as they extracted tin from the gravel of their native country."

In the *Sydney Morning Herald* of 28th September, 1847, there is a geological comparison of Russia and Australia, contributed by Mr. Clarke. He alludes therein to the views of Sir R. Murchison, then recently promulgated, respecting the probable occurrence of gold in Australia, and after quoting from a description of the Ural Mountains, he proceeds: "Now, we have here a third striking

resemblance to the condition of our Blue Mountain ranges * * * with an axis of chloritic and talcose schist and quartzites, with occasional limestones of Silurian age, in which occur metallic ores and gold in veins of quartz. * * * As on the flanks of the Ural the carboniferous formation reposes, so in this country occurs the very same order of deposits. It is, therefore, highly probable that, besides the lead and copper which exist in the Blue Mountain ranges, auriferous sands will be found in the rivers flowing from them. * * * New South Wales will probably, on some future day, be found wonderfully rich in metals."

Under the heading of "The Port Phillip Gold Mine," there appears an extract from the *Melbourne Herald* in the *Sydney Herald*, of 14th February, 1849: "On Saturday morning several persons left town for the scene of treasure at the Pyrenees. * * * In the meantime large lumps of gold have found their way to town, two of them weighing 22 and 24 ozs. respectively. * * * With regard to the shepherd boy, the original discoverer, his whereabouts is involved in mystery. * * * Two facts may be relied on—1st. That, from the specimens which we have seen, an immense mass of gold lies in the bowels of the earth, in the district of the Pyrenees, which has been thrown up in lava by volcanic action. [Observe the writer's idea of *facts !*] 2nd. That the only person who knows the locality is the shepherd boy alluded to, and who sold the lumps we have seen to Duchene and Brentani." In the *Herald* of 16th February, 1849, there is a letter commenting on the foregoing, evidently written by Mr. Clarke, although signed "Plutus." Among other things he says, "Gold is not so rare a mineral as many imagine, nor is there any lack of it in this country. It would not indeed be surprising if it should eventually be found in some abundance." He then describes how it usually occurs, and concludes, "It may do no harm to add that there is no instance of any man making his fortune by opening a gold-mine, and that it is only in countries where labour is as cheap as it is with slaves and serfs that even gold-washing pays." Subsequent experience must have led Mr. Clarke to modify that view.

In the same year (1849) Mr. Clarke contributed several articles to the *Herald* on California and gold-mining, describing also the method of crushing and amalgamating auriferous quartz, and concluding: "The particulars will, it is hoped, afford information to persons in this Colony who are anxious to work auriferous quartz, or any other gold ore." In 1849, also, he wrote to Sir R. Murchison on the subject of the progress of the Colony in mining matters, and in that letter the following passage occurs—"This Colony is becoming a mining country as well as South Australia. Copper, lead, and gold are in considerable abundance in the schists and quartzites of the Cordillera. Vast numbers of the population are going to California, but some day I think we shall have to recall them."

In a paper read before the Geological Society of London on May 4, 1852, Sir R. Murchison announced a geological discovery communicated to him by the Rev. W. B. Clarke, namely, "the existence of many fossils of known Silurian species, and many shells and corals, on the flanks of the Dividing Range in New South Wales. This discovery is important, because it completes the resemblance of the Australian Cordillera to the Ural Mountains, the two chains being thus shown to be zoologically, as well as lithologically similar, and both to possess the same auriferous constants."

The position to be accorded to the Rev. W. B. Clarke in the discovery of gold is fairly stated by Professor Geikie in his "Life of Murchison." "Count Strzelecki appears to have been the first to ascertain the actual existence of gold in Australia; but at the request of the colonial authorities the discovery was closely kept secret. The first explorer who proclaimed the probable auriferous riches of Australia, on true scientific grounds, that is, by obtaining gold *in situ*, and tracing its parent rocks through the country, was the Rev. W. B. Clarke, M.A., F.G.S., who, originally a clergyman in England, has spent a long and laborious life in working out the geological structure of his adopted country. He found gold in 1841, and exhibited it to numerous Members of the Legislature, declaring, at the same time, his belief in its

abundance. While, therefore, geologists in Europe were guessing, he, having actually found the precious metal, was tracing its occurrence far and near on the ground."

In the foregoing outline I have not introduced what seems to have been absolutely the first mention of native gold in this country. In the Surveyor-General's Office there is preserved a field book belonging to Mr. Assistant-Surveyor James M'Brian, in which the following entry occurs, referring to a spot on the Fish River, about midway between O'Connell Plains and Diamond Swamp, and under date February 15th, 1823:—"At this place I found numerous particles of gold in the sand in the hills convenient to the river." I attach no importance whatever to this entry; for in the first place it does not seem that specimens were exhibited to any one or the discovery made public in any way; and secondly, yellow scales of mica and particles of golden-coloured pyrites have frequently been mistaken for gold, and we do not know that Mr. M'Brian was competent to distinguish them. The particles being described as "in the sand in the hills," makes it not improbable that they were simply mica.

Gold-digging as a colonial industry had its beginning on 12th February, 1851, when the first cradle-washing was obtained by Mr. Hargraves on Lewis Ponds Creek. It cannot be said that Mr. Hargraves first discovered gold in the Colony, but he was the first to show the simple means of extracting it from drift deposits. The train had previously been laid by Mr. Clarke, and now the match was put to it by Mr. Hargraves, and with magical rapidity the gold-digging frenzy, as it may be called, overspread the whole country. Mr. C. Blakefield, writing from Sofala to the Rev. W. B. Clarke, under date 11th September, 1852, says:—"About nine years ago I gave you a piece of gold in quartz found at Mitchell's Creek, and brought down by M'Gregor, the shepherd, when you informed me that nearly the whole of the rivers on this side of the Dividing Range were highly auriferous. At the time, I asked you why you did not make the fact known to the public; when your reply was that you were afraid that it would tend to the utter

disorganization of society, particularly as then constituted. But had I known that the whole science of gold-washing lay in the shaking of a tin dish, I am doubtful whether any such considerations of public policy would have prevented me from essaying the facts at the time, particularly as a friend of mine was also at the time extremely urgent upon me to join him in a prospecting tour."

The discovery of profitable gold-fields in Victoria followed soon after the practical commencement of gold-digging in New South Wales. Early in 1851 Mr. Clarke had announced that "gold ought to be found, if at all, in the province of Victoria, between longitude 143° and 145°, north and south of 37° south latitude," and in a Report of a Committee of the Legislative Council of Victoria it is stated that "Mr. T. Hiscock, a resident of Buninyong, induced by the writings of the Rev. W. B. Clarke, and by the discovery of Brentani's nugget in the Pyrenees district five years before, had kept a constant look-out for gold in his neighbourhood. * * * * It is obvious that Mr. Hiscock's discovery at Buninyong, by attracting great numbers of diggers to the neighbourhood, was the cause of the discovery of Ballarat, which is in fact upon the same range, and at no great distance."

About two years later the impulse spread to New Zealand. A correspondent from that Colony wrote in 1853 to the *Illustrated London News* as follows:—"The New Zealand settlers were first led to search for gold in their country by an opinion of the Rev. W. B. Clarke, the Government Mineralogist in New South Wales, expressed in the geological reports of that gentleman on the Australian gold-fields, and which was to the effect that a similar geological formation to that of the auriferous mountains in California, and of Bathurst, New South Wales, might be expected to exist in the principal mountain ranges, extending in a direction north and south in New Caledonia and New Zealand."

In August, 1851, the Government of Sir Charles Fitz-Roy, the Hon. E. Deas-Thomson being Colonial Secretary, commissioned Mr. Clarke to make a geological exploration of the southern districts

of the Colony, with a special view to the indications of gold. This expedition lasted about nine months, and involved a journey of nearly 3,000 miles. His reports to the Government during this journey were afterwards collected and published, with additions, in 1860, forming the volume entitled "Researches in the Southern Gold-fields." Mr. Clarke's equipment was of a scanty character, and he was often indebted to the settlers on his route for aid in the prosecution of his labours. He says:—"The Government furnished me with all I requested, but I found that without a geological staff, and with only two men to perform the necessary duties of encamping, cooking, and grooming, and without any aid of a scientific kind, it was impossible for me to carry out fully all I desired to do.'

Traversing for the most part a wild country, without good roads and with few inhabitants, he suffered exposure and hardships which affected his health, and even endangered his life. As an example of what he had sometimes to encounter, I quote the following narrative from "Researches, &c.," page 64:—"As we were approaching the Berudba River, which one of my attendants spoke of as being very difficult to cross in time of flood, and as we saw ahead of us a very threatening sky, as if a furious tempest was brewing to the south-westward, I was induced to go forwards in the hope of crossing the river before the storm broke. We had, however, scarcely gained the left bank and set foot on the Manero territory, when we were met by a furious whirlwind of dust, hail, rain, and thunder, accompanied by vivid flashes of lightning dashing along the ground. As I crossed the river I saw, for a moment, up the valley, patches of what appeared to be snow; but these were nothing but vapour, suddenly condensed close to the earth by the sudden change of the atmosphere. In an instant all objects were completely obscured except within a yard or two. The horses, two of which were drawing the cart, and the other ridden by myself, immediately turned round to avoid the blinding gusts of dust, rain, and thunder. The dust came on at first exactly like a large wall, and, with the hail, frightened the horses. In about three

minutes we were all drenched to the skin, and there was not time to put on extra covering, though it became very cold. * * * * Soon we heard the roar of waters, and a furious flood came rushing along our track, roaring and hissing, and reminding one of a cascade. * * * We contrived, with much difficulty, to get the cart up a height to the left of the road, and when the moon broke out from the clouds about midnight we saw that we were on a nearly bare porphyry hill without any neighbouring wood, save a few dead trees, and we had first to cut down one of them before we could make a fire. At last we did so, and by the morning we had dried our clothes, but as it was impossible to put up any canvas for a covering, we had to pass the night the best way we could." And again, from page 120:—"On Friday, 19th, we proceeded * * * * * to a swampy springy mountain about 6,000 feet above the sea, above Wadymandouree and Buckwong Creeks, which run into the Indi or Upper Hume. It was difficult to find a spot on which to lay our blankets on account of the bull-dog ants. But we had scarcely done so when a most furious tempest came on, and we were deluged with rain. * * * We were up and on our way at 5 a.m., and wending through dense scrub as we could we travelled, as yesterday, along a succession of schistose spurs, strewn with innumerable fallen trees to a swamp; and then ascending a low range at Wanga, came to the Indi at Piaderra, where we crossed it. No sooner had we reached this den of heat, damp and flies, than another tempest more furious than that of the preceding night pounced upon us. We camped, however, beyond the brush and spent Sunday. Then I became very ill. Next morning we started a little before 5 o'clock, and after some flirtation with scrub, low and steep hills and flats, mounted a nearly vertical wall of slate to Woolayian, and descended instantly just as steeply the other side of a knife-edge, to a swiftly flowing, snow-fed affluent of the Indi, at Mow-wat, and again mounted a wall of slate to Jungunora and Doornaman. In this ascent I fainted twice, and was laid out as if dead, or dying, on the first flat, stopping the whole party. I was cold as death, yet burning hot, unable to stand, scarcely able to breathe, and I really thought I

was dying; but after a rest of an hour I proceeded, and came with difficulty through a dense scrub, masses of fallen trees and swampy ground, with blocks of gneissiform and concretionary granite to Burramungee and Narramplat, and then to Theroton, and camped under a peak of Muniong, near Kosciusco. I lay ill for several hours in a hollow—under the shadow 'of a great rock in a weary land,' and then proceeded to do what I could. Four thunderstorms passed over us, grand from our position, which commanded the kingdoms of the world and the glory of them. The night was fine, but chilly at dawn; and such a sunrise greeted my eyes as I shall not speedily see rivalled. I lay facing the east, and saw all the process of dressing the day, and wished I had been a Turner to have transferred the tints of that glorious drapery, in which morning marched along the horizon, to the canvas." Need I call your attention to this exemplification of the ruling passion, which made our explorer, when struggling painfully onwards, and even as he thought face to face with death, still watchful and observant of every geological feature by the way, and able to identify and in due course record, the "blocks of gneissiform and concretionary granite" that obstructed his path.

The time that I have at command on this occasion prevents me following further the continued labours of Mr. Clarke in laying open the metallic treasures of this country; and in concluding this section I will quote the words with which he closes his volume of "Researches":—"For myself I only ask for that acknowledgment which my own share in the advancement of the Colonies may receive from impartial judges; and if that acknowledgment declares that under difficulties, without scientific aid, without sympathy, and in spite of a thousand inconveniences, I did my part up to 1851 as a loyal citizen of the land in which I dwell, I shall be satisfied." That acknowledgment I feel sure that this Society will heartily accord.

Another geological question with which Mr. Clarke's name is inseparably connected refers to the age of our coal-fields, but to this I can give little more than a passing notice. It was chiefly, I

believe, in acknowledgment of this department of Mr. Clarke's labour that the Murchison medal of the Geological Society of London, of which he had been a member for half a century, was conferred upon him in February, 1877. The President, in presenting the medal, said that it was in recognition of Mr. Clarke's "remarkable services in the investigation of the older rocks of New South Wales,—services which have led to a correct knowledge of the succession of the formations in that country, and which have been of great value to the community. Mr. Clarke's labours date back nearly half a century, and he had contributed several interesting essays on points of British geology before he commenced his arduous work amongst the coal-bearing strata of his adopted country. Influenced by the love of scientific investigation, and aided by a self-reliant and independent character, he surveyed those great depths of rock which brought the local names of Hawkesbury, Wianamatta, and Newcastle, before the geological world as land-marks in an apparently anomalous series of strata. His survey, the result of years of patient labour, was so exact, that in spite of former unsparing criticism, it is now universally recognized as correct; and his deductions as to the relative value of marine and plant-bearing strata, in estimating the ages of formation, though disbelieved in former years, have been proved to be consistent with facts since observed in Africa, India, and North America * * * * Science owes much to Mr. Clarke for the consistent and persistent manner in which he has upheld his opinions regarding the age of these Australian Carboniferous series."

In his latest work—"Remarks on the Sedimentary Formations of New South Wales," the 4th edition of which he completed on his 80th birthday, Mr. Clarke enters fully into the argument respecting the age of our coal, and details the reasons that first satisfied himself, and afterwards satisfied other geologists, that the coal of New South Wales belongs to the Palæozoic epoch, the same as the most valuable coal deposits of Great Britain, notwithstanding the occurrence of *Glossopteris*, which in other parts of the world is held to belong to the Mesozoic epoch.

A competent critic of this work says of it, in the *Sydney Morning Herald*, that it is the most valuable portion of Mr. Clarke's labours, and "represents in epitome the results of the work of his life. We refer more especially to the appendices which contain all that is known of the Palæontology of New South Wales. That knowledge has hitherto been scattered over many works, all of them difficult of access to the general reader, and some of them becoming very scarce." As there was no sufficient collection of typical fossils for comparison in the Colony, Mr. Clarke had to send his specimens to other countries for identification. Respecting this, he narrates, in the appendix to "Remarks, &c.," the many efforts he made to obtain the opinions of competent men on his collections, and the difficulties and disappointments he met on every hand. "In this extremity," he proceeds, "I consulted Professor T. Rupert Jones, who recommended me to seek aid from Professor de Koninck of Liege, who * * has most ably, indefatigably, and willingly accomplished it, to his own reputation as I hope and believe, and certainly with much honourable acknowledgment or myself. I had myself begun the work in a small way by making drawings to scale of more than 1,200 individual specimens collected by me from the carboniferous beds. * * * They were never published, and it was the feeling that it was a work beyond my own powers to do justice to it, coupled with want of pecuniary means and of leisure from my parochial duties, that induced me to look to professional and acknowledged authorities in Palæontology, out of the Colony."

Following up his examination of Mr. Clarke's specimens, Professor de Koninck has recently brought out two volumes on the Palæozoic Fossils of New South Wales, with many lithographic illustrations. A reviewer of this work in the *Herald* properly points to it as a conspicuous monument to the zeal and energy of our veteran geologist, being entirely the fruit of his hard labour and patient gathering of facts extending over some forty years. Mr. Clarke had to give pecuniary aid towards the publication of this work, and the specimens named and figured by

Professor de Koninck were all returned to Mr. Clarke. It is gratifying to know that by the liberality of our Legislature this invaluable collection of named fossils, together with the remainder of Mr. Clarke's collections, and also his scientific library, and the geological map which he had completed before his death—all will now be public property, and will no doubt be displayed in some institution convenient of access, for the benefit and instruction of the public. Doubtless you are all aware that last week the Legislative Assembly voted £7,000 for the purchase of the Clarke collection.

Along with his geological labours Mr. Clarke brought his powers of keen observation to bear on the meteorology and physical geography of the Colony, and contributed much valuable information regarding winds and weather, rainfall, earthquakes, and other phenomena. In one of his later papers to the Royal Society he called attention to a matter which is being culpably neglected in Australia, as in some other countries, but which our colonial Governments ought to take into serious consideration before irreparable mischief is done. The paper to which I allude is entitled "Effects of Forest Vegetation on Climate," and was read 1st November, 1876. In this paper Mr. Clarke brings together a valuable mass of evidence to show that destruction of forests tends to diminish rainfall and dry up springs; not omitting, however, some cases where exactly the opposite effects seem to have been observed. But as to these he says:—"It seems to me perfectly clear that there may be other physical causes * * * for the local alteration in the water supply." And again—"The mass of evidence supplied in the present paper from all parts of the world must, I humbly conceive, overbear any inference from unexamined phenomena brought against that evidence." Further on he says: "It has been my privilege at one time or another during my various journeyings to visit the sources of almost every important river and stream in this Colony, and it was not without some dread of the future that I have seen the possibility of the country becoming greatly deteriorated as to its water

supply. * * * Would it not be wise in the Government to make provision against wilful destruction of the woods and forests that border our rivers; to prevent clearing and ring-barking, except under regulations—the latter, as sometimes practised being one of the most suicidal of schemes, as will be found perhaps at no distant date?" And he quotes some eloquent words from a lecture on Forest Culture, by the Baron von Müeller: "I regard the forest as an heritage given to us by Nature, not for spoil or to devastate, but to be wisely used, reverently honoured, and carefully maintained. I regard the forests as a gift entrusted to any of us only for transient care during a short space of time, to be surrendered to posterity again as an unimpaired property, with increased riches and augmented blessings, to pass as a sacred patrimony from generation to generation."

With this imperfect outline of Mr. Clarke's scientific labours, I must hasten to a close. The hardships and exposure incident to his geological explorations had made inroads on what must have been a sound and healthy constitution, and in his later years he had several attacks of severe illness. In 1870 he resigned the ministerial charge of the parish of Willoughby, although retaining his position as a clergyman of the diocese of Sydney; and thenceforward he devoted his leisure, so far as health would allow, to geological studies, and to the arrangement and naming of his large collection of specimens. It is pleasant to think that in his last days he suffered little pain; he seemed even to be brighter and more cheerful, and his faculties remained unclouded to the end. He had seldom to intermit his favourite studies. He had just finished his geological map, and his book on the Sedimentary Formations; and on the last day of his life he busied himself arranging fossils, and in writing a letter to Professor de Koninck. Through the kindness of the family, I am permitted to quote from this letter, and I introduce the greater portion of it for the sake of the interesting particulars relating to Mr. Clarke's last illness: —"Branthwaite, 15th June, 1878. My dear Professor de

Koninck,—You have doubtless expected to hear from me before this, but I have been sorely hindered in writing. I have before told you of my general weakness in health since the first days of August last; but I did not anticipate such a culmination as I have since experienced, and from which I am only now slowly recovering. I went with the Chief Engineer of Railways in beginning of August to the Liverpool Range and Plains, and visited some of my old camps in 1851-2, returning the better for the journey to and fro. This amendment was followed by paralysis of my left side and limbs, and this is the second letter I have attempted since the date of the attack, which was the 6th of March. I was seated in my arm-chair in this my study, when, trying to rise to get down a book, I found myself a prisoner, bound hand and foot, and after two hours struggling to lift myself I gave it up, and began to call for help with cries of fire, murder, thieves, &c., which I soon discovered was useless, as I found my speech anything but intelligible. Knocking on the floor with my right foot brought my son from the garden, and I was soon attended by my usual medico, Dr. Ward, and by a young friend of his, Dr. Kyngdon, who with my son carried me upstairs to bed, where, with some exceptions, I have chiefly rested. Dr. Kyngdon said to me, 'Put out your tongue,' and this done, he observed, 'Your tongue is half paralyzed.' This was intimation to me of my condition. I am now, however, so far recovered as to be able to walk upstairs step by step, holding the banister; but I can only come down sideways, crab-like, with both feet on a step, the left sliding over the one above; and I have once, by aid of two assistants, managed to visit a friend across the road. Dr. Ward said to my wife * * * that he did not think that I should recover, and now he has expressed to me his astonishment that I am so far towards health. I must apologize to you for this scrawl, but I did not like to wait till I could write better * * * I had just completed the MSS. of a fourth edition of my 'Remarks' when the stroke came, and by the help of my son I have got it through the press, but the copies have not yet left the printing-office * * * I had a somewhat similar attack in 1856, which occurred on Easter Sunday, in

church, and I had a hard struggle to get through my ministerial duties. But God is ever merciful, and I am not despairing of his loving-kindness towards me now. All my friends will have it that I have suffered from over-work about the book. Perhaps they are right, for I had to make a good deal of research to complete it * * * * My new edition brings up all to 1878, and gives lists of fossils, from various authorities, with fresh sections and a small map. I hope you have in some degree recovered from the effects of your severe sorrow and, with the warmest regard, sympathy, and gratitude, I remain, my dear friend, your very sincere, W. B. CLARKE.—P.S. * * * * * Lastly, give me absolution for this letter, which is a shameful production, but I cannot do more." These concluding words had a deeper significance than the writer was aware of. About the middle of the same night he was heard making some noise in his room. His son went to him and found him standing on the floor complaining of pain across the chest. He was assisted into bed and the doctor sent for, but within ten minutes it was all over. On June 18 the Council and many members of the Royal Society paid the last tribute of respect and affection to their late Vice-President by following him to the grave. And now we shall long miss the well-known face at these meetings, and the cheery voice ever ready with a kindly greeting for his fellow members and friends.

You are aware that the Society is making an effort to establish a lasting memorial of Mr. Clarke as the pioneer geologist of Australia. It is intended that this should take the form of annual lectures on Geology, free to the public; and also of a gold medal to be given from time to time as a reward of meritorious contributions to geological science, having reference of course chiefly to Australia—the lectures and the medal to bear Mr. Clarke's name. The subscriptions to this fund have not yet met the expectations of the Committee, but they trust still to be able to carry out the Society's intentions.

Another member of the Royal Society, and a conspicuous member of the community, has passed away during the year—

John Dunmore Lang, D.D. He was more prominent as a citizen, and in political, educational, and religious questions, than as a member of our Society, and hence it is not necessary that I should enlarge as on the subject of my preceding notice.

Dr. Lang was born in Greenock, Scotland, in August, 1799. After preliminary training in the parish school of Largs, he attended the University of Glasgow for eight years, four years in general study for the degree of M.A., and four years in theological studies. Having obtained license and ordination, according to the forms of the Church of Scotland, he determined to emigrate, and he arrived in Sydney in May, 1823, being the first, and for several years the only, Presbyterian Minister in Australia. In 1824 the building known as the Scots Church was erected for him on Church Hill, and he continued the minister of it till his death. Full of zeal and energy, he travelled much over the Colonies, and made repeated voyages to his native country, partly to promote immigration, and partly to obtain clergymen and schoolmasters for his scheme of church extension, and for the promotion of the higher education of the people. He was chiefly instrumental in establishing the Australian College, which for a number of years did good work in Sydney.

In 1843, on the first introduction of a representative element in the local Legislature, he was elected as a Member for Port Phillip. In 1850, after returning from a lengthened absence, during which he had travelled much in Great Britain and America, and done much to promote emigration, he was elected as a representative for Sydney, and several times afterwards he was elected for the same constituency. He finally retired from Parliament on the occasion of the union of the different bodies of Presbyterians to form one Church, in 1865.

Dr. Lang wrote several books on the Colonies, besides many controversial pamphlets. He became a member of the Royal Society in 1867, and read several papers on the "Origin and Migrations of the Polynesian Nation," and one on "New Guinea

as a Field for Settlement and Colonization." He died 8th August, 1878, having been conspicuously associated with the history and progress of the Colony for over half a century.

The other members whom the Society lost by death during last year were Hon. Robert Owen, and Messrs. Samuel Bennett, J. H. Bradridge, and A. H. C. Macafee. None of these members contributed any papers to the Society.

Connected with these obituary notices, I ought not to omit mention of the late Professor Pell, although for three years he had ceased to be a member of the Society. He joined the Philosophical Society when it was revived, in 1856, and read two or three papers to it, one being an interesting investigation into the "Distribution of Profits in Mutual Assurance Societies." He served on the Council of the Royal Society for three years, during two of which he was one of the Honorary Secretaries. In 1867 he read a paper "On the Rates of Mortality and Expectation of Life in New South Wales as compared with England and other countries"; and he afterwards followed this up by a series of valuable articles in the *Herald*. In 1871 he read a paper "On the Constitution of Matter," a profound investigation which does not seem to have gained from mathematicians and physicists the attention it deserved.

Mr. Pell was born at Albion, in the State of Illinois, in March, 1827. Removed at an early age to England, he was educated at the Grammar School, Plymouth, and afterwards at St. John's College, Cambridge. He took his B.A. degree, and went out as Senior Wrangler, in 1849. He then became Fellow of his College, and remained there for three years as Tutor. In 1852 he was appointed the first Professor of Mathematics and Natural Philosophy in the University of Sydney, where he continued till 1876, when increasing ill health made it necessary for him to resign. For a number of years he was Consulting Actuary and Actuary to two of the principal Life Assurance Offices of Sydney. He was frequently employed by Government on commissions of inquiry—one of the earliest being to investigate the condition of the survey and triangulation of the Colony then being carried on by Sir

Thomas Mitchell. He was afterwards engaged on an inquiry into the cause of a serious railway accident between Sydney and Parramatta, in which several lives were lost; also on the Hunter River Floods Commission, and on the City and Suburban Sewage and Health Board, of both of which he acted as Chairman. In all these inquiries he showed a clearness of judgment and a desire to get to the root of difficulties which made his services of much value to the public.

He was one of the Trustees of the Sydney Grammar School from the time of its first institution, and was for some years Chairman of that body. In 1863 he was called to the Bar of New South Wales; and in 1878 he was elected a member of the Senate of the University, his former seat on the Senate having become vacant when he resigned the Professorship. He died on the 7th of the present month.

These obituary notices have run to such a length that I am sure the members will be glad if I do not trespass further on their patience. I therefore conclude with a wish that the present year may be a prosperous one for the Society, and that it may be long before such another list of losses by death may have to be recorded.

The "Gem" Cluster in Argo.

By H. C. Russell, B.A., F.R.A.S.

[*Read before the Royal Society of N.S.W., 4 June*, 1879.]

The small cluster of stars which I have ventured to call the "Gem" cluster seems to have been strangely neglected by astronomers, probably because it is situated so close to η Argus and a host of other interesting objects demanding attention. There can at least be little doubt that the time which Sir John Herschel devoted to the remarkable nebula and cluster about η Argus obliged him to pass over this striking object. The recorded observations of it are not numerous. Its position was first recorded by Lacaille, who entered it as No. 4,375 of his catalogue simply as a nebula, without any remark as to its character or the size of the stars. Brisbane observed it twice, and entered it first as No. 3,105 of 7th magnitude, and the remark—"In the centre of a cluster of very small stars very close together, and about 6 minutes in diameter." Again, as No. 3,107 with no magnitude, but as a nebula, or star, in the centre of a cluster. Dunlop, who observed clusters and nebulæ with a reflector of 9 inches aperture and 9 feet focus, erected at his private house, enters this object as No. 321 in his catalogue, with the remark—"A very small cluster of very small stars, figure round, about 4 minutes in diameter, rich in extremely small stars resembling faint nebulæ." Taylor observed it, but only gives the position without remark as to the character of the object. Herschel, as I have said, passed it over, that is, he recorded its position (No. 3,276) and remarks only "A fine, bright, rich, not very large cluster," and leaves it without a hint of the number or magnitudes of the stars. Such is the meagre account which, so far, astronomers have given of this beautiful cluster. It is true the dimensions are not large (about 7 minutes in diameter), but the beauty and symmetry of form in which the brightest stars are arranged—a double curve fairly representing the letter M, with a miniature Southern Cross in the centre and a bright red star at the foot—combine to make this a little "Gem," which, in the estimation of many observers, is quite equal to the well-known κ Crucis. My own estimate is that it is not such a striking object, and it is certainly not so rich in colour. Nevertheless the red star is much larger than the corresponding one in κ Crucis, and all the bright stars, consisting of three of 7 magni-

tude, one of 7½ magnitude, six of 8 magnitude, seven of 9 magnitude, twelve of 10 magnitude, are, with three or four exceptions, collected in a small square space only 4 minutes each way, while in the other cluster the bright stars are scattered over double the space; and although the colours in that cluster are very remarkable, they are "star colours," and therefore seldom seen by an observer at first glance. Certain it is that we have in this cluster a most brilliant object standing as one of the outliers of the richest portion of the heavens; a portion where coloured stars, double stars, clusters, nebulæ, and star dust, have been strewn with no sparing hand, a perfect mine of wonders either for the star-gazer or the astronomer. An attentive examination of this cluster on a dark clear night, and with the aid of a powerful telescope, reveals conditions of deep interest; and one of the first of these to strike an observer accustomed to look for double stars is that, although we have here 144 stars very close together, there is amongst them no double star, unless indeed No. 35 in D quadrant with a companion of seventeenth magnitude be taken as such. Again, the star-dust which forms the back-ground of the Milky Way is here not continuous. It seems to cluster in that part where the stars are most numerous, forming together a brilliant centre; and in the parts immediately following this in right ascension, where the stars are less numerous and smaller, it becomes patchy, looking like high cirrus clouds on a clear sky, and giving the observer the impression that he is looking at star clouds floating between him and space, which forms an absolutely black background; the cloud-like forms seem to make irregular streams, which are finally lost in the complete blackness of the Coal-sack which I have endeavoured to represent in the diagram. Not a vestige of star-dust can be seen here; under very favourable atmospheric conditions a few (six) of the most minute and scattered star points can be seen. I was only able to determine the position of one, but the whole of the space indicated is far blacker than the major part of the great Coal-sack near the Cross, and only comparable with that small section of it found near the centre of that extraordinary spot. This remarkable black space lies nearly altogether in the south following quadrant marked B, and extends from a point 34 seconds after the zero to 60 seconds, and near these points are two relatively bright stars, which look like sentinels guarding the opening. On the south side it extends in a rounded shape beyond the limits of the map, and on the other side it tapers away to the north following side. Its general outline is pear-shaped, and its greatest length nearly in a parallel of latitude; but I do not wish to convey the idea that it has definite boundaries. The finer the night, the more intense is the blackness, and the more easily seen is the star-dust surrounding it; yet branches of the one and streams of nebulous light from the other seem so interwoven that it is not possible to see satisfactorily the bounds of light

and darkness, but the general form which I have described can be made out with ease. The more I have studied this object the more I am convinced that these light streams, as I have already said, are like clouds floating in our atmosphere, in so far as such a simile can convey the idea that they are nebulous clouds floating between us and the blackness of space; and while looking at them "it is (as Humboldt justly observed) impossible not to believe that the visual ray has really penetrated into space, traversing the entire thickness of the stellar stratum which surrounds us"; and yet at other times, when looking at the same place through a clearer atmosphere, minute and scattered star points begin to appear, and one asks—Are these the brighter stars of some distant galaxy? Is it after all only an open space in the star depths, such as one sees in their lateral expansion—only a loop in a link of that chain which binds us to infinity? The question may be asked have these stars increased in brilliance since first observed, and it is of some moment, for the examination of κ Crucis, with a much smaller telescope than that used by Herschel, revealed twenty-five stars that he had not seen; but when we refer to past records of them they are not sufficient to make a safe comparison with the present. Lacaille and Taylor, as we have seen, both set this down as a nebula, but said nothing of the stars; Brisbane speaks of it as a cluster of very small stars, and Dunlop in his own work, using as we have seen a rather large telescope, also calls it a cluster of very small stars very close together. With such a telescope as he used the description would not apply now—the cluster of bright stars could hardly be called "small ones with a generally rounded form." Unfortunately, Dunlop so often manifested a want of care in describing what he saw that this evidence is, I fear, not of much value. It is to be regretted that Sir John Herschel, who saw it soon after Dunlop, did not leave some more valuable account of it. "A fine, bright, rich, not very large cluster," are terms which might apply to clusters of very different relative brilliance, especially when nothing is said about the magnitude of any of the stars. Brisbane is the only one who mentions a magnitude, and he calls the centre star which he observed, 7-magnitude, as I have done. It does not appear, therefore, that there is any proof of change in the brilliance of this object; yet it is remarkable that one which is now so bright should have been passed over with so little notice. In arranging these stars in the catalogue I have departed from the usual plan, and adopted one which is much more convenient in the making, and which I think makes it easier to refer to the positions of the stars. The plan in question consists in dividing the map into four quadrants, and measuring all the declinations from the zero line, passing through the reference star, and entering them in the order of increase without signs. The four quadrants are thus marked:

A is south preceding, B south following, C north preceding, D north following. This arrangement seems to have several advantages. It divides the stars into four lists, which makes it easier to find any particular star; then it is only necessary to see on the map the quadrant and the approximate number of seconds from the zero line and the star can at once be found in the list, without any confusion such as often arises when signs are used. In determining the positions of the bright stars the parallel wire micrometer of the large telescope was used in this way: it was adjusted until the parallel wires were in parallels of declination; the fixed wire was then made to bisect the red star, and the other to bisect the star whose position was to be determined. The two stars were then allowed to transit the cross wire in succession several times, and the mean of the differences in their times of transit taken as the difference in R.A. between the zero and the star under observation. At each transit the position of wires showing difference of declination between the star and the zero was examined and found or made correct. After all the stars bright enough to have their positions thus measured were catalogued, an entirely independent set of measures was taken as a check upon the accuracy of the work, and the results will be found under the head of remarks. These measures were made on the 7th May. All the measured stars were then carefully plotted on a map in their relative positions, and this was used at the telescope as a guide for putting in the stars too small to be measured; the positions of these were frequently verified by eye-alignment and triangulation, and then their co-ordinates on the map were measured and entered in the catalogue. From the catalogue thus formed, I plotted the stars directly on to the metal block from which the map has been printed. One of the printed maps was then given to my assistant, and he measured the positions of all the stars on it, and arranged them in a catalogue, which was compared with the original. It was found that I had omitted to plot two very small stars, and he had mistaken a white speck for a star, otherwise the catalogues agreed. It will be observed that the map extends much beyond the proper limits of the cluster. It was so extended for the purpose of taking in the remarkable black space which I have described. In the catalogue will be found the magnitudes and positions of 144 stars. Many of these are extremely small, and it was impossible to measure with the micrometer their positions, because the light necessary to see the bright wire was sufficient to hide the stars. There are a few other stars scattered through the cluster, but so small that I have not thought it worth while to record their places. They are fainter than those I have put in the catalogue. The position of the red star determined by the transit instrument, and reduced to January 1, 1879, is—R.A., 10h. 31m. 7·28s.; Dec., S. 57° 37′

34·58″. In the catalogue all the stars determined by putting them in the map, and then measuring their places, have been marked E, to indicate that the position is estimated in the way described.

A few words about the way this map has been printed may not be out of place here, since this is the first star map that I have prepared in this way. Some at least of the members present will remember that, at a recent meeting of the Astronomical Section I described a process by means of which any astronomical observer, with very little more trouble than is required to make a drawing of his work upon paper, may produce a block from which he can print as many copies as he requires. The process is not altogether new; engravings are frequently made in type metal, but by the hands of trained engravers. I found that any lines marked on the type metal or holes made into it, even with fine needle points, would print white, or more correctly, not print at all. For the reference lines then, I simply ruled them as I would upon paper, using a steel point instead of a pen; for the stars I used either round punches or drills, with which holes of the required size were made in the metal; and for the very fine white spots which are meant to represent star-dust I used a bundle of fine needles fixed together. The figures upon the block are simply punched in, and the words at the side are engraved. I have thus been able to produce a map which it would have been almost impossible to get done by the ordinary methods of engraving, and I think quite impossible by lithography, and to do it myself in much less time than would have been required to draw it on paper and watch it through the engraver's hands. I consider this process of considerable importance to astronomers, because they will now be able to represent what they see without having the life filtered out of it by the engraver, simply because he cannot be made to understand what he has never seen.

CATALOGUE OF STARS IN THE "GEM" CLUSTER.

List of Stars in A quadrant.

No.	Mag.	Seconds before zero.	Secs. Dec. south of zero.	Remarks.		
					s.	″
1	12	20·7	7·74			
2	12	0·8	36·66			
3	10	11·8	42·14	Micrometer	42·22	42·06
4	15	E 7·4	47·00			
5	15	E 3·3	74·00			
6	11	6·7	85·85	,,	85·70	85·92
7	10½	17·1	103·26			
8	13	12·9	117·33			
9	11	7·9	132·42	,,	133·24	131·60
10	14	E 16·0	188·00			
11	13	E 3·0	195·00			

All marked E not measured with micrometer. Total, 144 stars.

Stars in B quadrant.

No.	Mag.	Secs. following O.	Secs. Dec. south of O.	
1	15	E 16·7	5·00	s. ″
2	10	10·05	6·73	Remeasured on May 7, 9½ 9·75 5·83
3	15	E 37·02	7·00	
4	12	5·15	11·52	,, ,, 10 5·25 11·47
5	16	E 28·50	14·00	
6	15	E 32·30	15·00	
7	15	E 13·60	17·00	
8	16	E 10·00	25·00	On following side of coal-sack too faint to measure difference in declination.
9	15	65·50	25·00	Remeasured on May 7, 9 17·70 27·09
10	10	17·40	26·05	
11	17	E 2·00	35·00	
12	16	E 43·60	35·00	,, ,, 10 23·45 37·41
13	11	23·70	37·63	
14	12	13·40	39·29	,, ,, 9½ 10·40 44·73
15	9	10·55	44·73	,, ,, 12 1·40 47·28
16	12	1·25	47·80	
17	16	E 20·00	58·00	
18	11½	5·20	58·56	
19	17	E 53·70	65·C0	
20	16	E 18·70	67·00	
21	15	E 23·00	67·00	
22	15	E 25·70	67·00	
23	16	E 4·80	72·00	
24	14	E 1·60	75·00	
25	17	E 39·70	85·00	
26	15	E 20·00	86·00	
27	15	E 23·80	93·00	
28	11	1·10	114·38	
29	8	32·00	115·86	
30	12	21·10	124·82	
31	15	E 11·70	168·00	
32	11½	29·35	168·49	
33	15	E 15·40	173·00	
34	13	E 7·0	180·00	
35	8	62·45	188·51	
36	13	22·00	188·95	

Stars in C quadrant.

No.	Mag.	Before zero.	From zero.	Remarks.
1	13	3·95	34·14	
2	10	3·90	44·42	
3	15	E 9·50	47.00	
4	13½	0·40	56·42	
5	13	4·10	57·73	
6	17	E 11·00	60·00	
7	17	E 18·00	61·00	

Stars in C quadrant—*continued.*

No.	Mag.	Before zero.	From zero.	Remarks.
8	10	1·05	69·35	
9	13	19·05	74·02	
10	13½	5·85	97·34	
11	17	E 12·60	98·00	
12	16	E 3·60	103·00	
13	16	E 2·60	110·00	
14	11	15·33	113·27	
15	16	E 20·60	115·00	
16	8	3·15	119·30	
17	17	E 13·80	121·00	
18	16	E 20·70	127·00	
19	15	E 6·70	138·00	
20	16	E 20·80	140·00	
21	13	7·00	152·84	
22	9	13·90	154·33	
23	13	E 20·90	167·00	
24	13	2·00	169·00	s. ″
25	7	1·97	190·23	Remeasured April 26th 7 2·0 190·07

Stars in D quadrant

No.	Mag.	Seconds following zero.	Seconds from zero.	Remarks.
1	7	0·00	0·00	Fine bright red star ; zero.
2	17	E 24·90	0·00	s. ″
3	10½	19·50	3·94	Remeasured 10½ 19·50 5·51
4	8	12·65	7·78	„ 9 12·65 6·98
5	12	41·10	10·37	
6	13	1·45	11·90	
7	16	E 29·70	13·00	
8	8	15·00	16·67	„ 9 15·05 17·25
9	15	E 8·30	18·00	
10	10½	22·05	18·19	
11	17	E 49·50	19·00	
12	16	E 25·80	20·00	
13	10	4·60	26·87	„ 10 4·55 26·27
14	9	14·45	28·89	„ 9½ 14·65 28·62
15	7½	2·90	31·19	„ 8½ 3·00 30·54
16	16	E 12·70	35·00	
17	16	E 11·00	37·00	
18	17	E 21·70	43·00	
19	11½	54·10	43·59	
20	17	E 9· 6	45·00	
21	16	E 52· 3	53·00	
22	10½	10·65	54·11	„ 11 10·85 54·85
23	13	3·20	66·83	
24	16	E 8· 1	67·00	
25	12	44·00	71·59	

Stars in D quadrant—*continued.*

No.	Mag.	Seconds following zero.	Seconds from zero.	Remarks.			
						s.	
26	17	E 17·50	75·00				
27	7	5·70	75·87	Remeasured	8	5·75	75·95
28	15	E 29·10	80·00				
29	8	13·65	83·33	„	9	13·90	82·84
30	15	E 3·30	84·00				
31	15	E 8·70	95·00				
32	16	E 17·20	97·00				
33	9	24·00	100·15	„	9½	24·05	100·83
34	16	E 14·60	103·00				
35	9	11·10	104·69	„	10	11·00	104·33
36	16	E 17·00	108·00				
37	17	E 10·50	108·00				
38	16	E 33·50	112·00				
39	17	E 3·50	118·00				
40	10	12·75	122·66	„	10	12·60	122·14
41	15	E 10·70	125·00				
42	16	E 8·60	126·00				
43	9	4·45	131·71	„	10	4·55	130·78
44	9	15·00	132·86	„	9½	14·75	133·08
45	16	E 21·00	137·00				
46	16	E 6·70	138·00				
47	15	E 23·50	138·00				
48	10	1·40	140·59	„	10	1·50	140·45
49	10	13·65	143·49	„	10	13·75	143·07
50	10	11·42	146·16				
51	10	9·00	147·99	„	10	9·00	146·97
52	16	E 6·30	150·00				
53	17	E 17·50	153·00				
54	12	E 22·60	168·00				
55	12	40·55	176·20				
56	16	E 36·20	180·00				
57	15	E 5·60	184·00				
58	16	E 22·20	187·00				
59	12	32·30	193·21				
60	17	E 18·00	195·00				
61	10	12·00	195·46	„	10	12·40	193·56
62	13½	29·40	209·41	„	14½		
63	17	E 19·40	210·00				
64	12	E 2·30	217·00				
65	15	E 11·70	217·00				
66	17	E 9·30	223·00				
67	16	E 25·20	232·00				
68	12	43·90	232·56				
69	13	E 59·30	235·00				
70	12	36·80	235·81				
71	13	E 13·40	240·00				
72	10	20·80	243·48	„	10	20·65	244.40

[Diagram.]

The International Congress of Geologists, Paris, 1878.

By PROF. LIVERSIDGE, University of Sydney.

[*Read before the Royal Society of N.S. W.*, 4 *June*, 1879.]

THE International Congress of Geologists held in Paris during the month of September last did not attract the amount of attention in England that it deserved; for the proceedings of the Congress were by no means devoid of interest, but, indeed, were of some considerable importance, especially as several very valuable papers were read and discussed; attention was also directed to certain lines of geological inquiry now urgently requiring the earnest study and consideration of all geologists. The Conference was a very successful one, and arrangements were made for holding such gatherings triennially, a great number of the members present pledging themselves to work at certain questions and to present reports embodying the results of their labours at the next Conference, which it was decided should be held at Bologna in October, 1881. The small amount of notice which the Congress attracted in England was probably mainly due to the fact that it took place almost immediately after the meeting of the British Association, and at a time when many other gatherings of a somewhat similar nature were being held; many persons were doubtless surfeited with scientific picnics, and others were, at that time, compelled to start for their real holiday excursions if they wished to take advantage of the short amount of autumn weather then remaining to them.

The Congress was opened at the Palace of the Trocadero on Thursday, August 29, under the Presidency of M. Bardoux, Minister for Public Instruction; there were from 350 to 400 geologists present, including amongst their number many of the most illustrious geologists from all parts of Europe and America; at this meeting the Council of Management was elected.

It should be here stated that the first Committee was elected at Philadelphia, during the time the International Exhibition was being held in that town in 1876, and was composed as follows:—

President: Prof. James Hall.

Secretary: Dr. Sterry Hunt, F.R.S.

Messrs. W. B. Rogers, J. W. Dawson, J. S. Newbery, C. H. Hitchcock, R. Pumpelly, and Lesley, as American members—in addition, Prof. Huxley (England), Dr. Otto Torell (Sweden), and Prof. H. de Baumhauer (Holland), were appointed as foreign representatives.

COUNCIL.

Honorary President:

M. BARDOUX.

President:

Prof. E. HEBERT, Paris.

Vice-Presidents:

For England	Mr. THOS. DAVIDSON, F.R.S., Brighton.
,, Australasia	Prof. LIVERSIDGE, Sydney.
,, Belgium	Prof. DE KONINCK, Liège.
,, Canada	Dr. STERRY HUNT, F.R.S., Boston.
,, Denmark...	Dr. J. STEENSTRUP, Copenhagen.
,, Spain	Prof. VILLANOVA, Madrid.
,, United States... ...	Prof. J. HALL, New York.
,, France	Prof. DAUBREE, Ecole des Mines, Paris.
,, ,, ...	Prof. A. GAUDRY, Mus. d'Histoire Naturelle, Paris.
,, Hungary	Prof. SZABO, Buda Pesth.
,, Italy	Prof. CAPELLINI, Bologna.
,, Netherlands	M. VAN BAUMHAUER, Haarlem.
,, Portugal	M. RIBEIRO, Lisbon.
,, Roumania	Prof. STEPHANESCO, Bucharest.
,, Russia	Prof. DE MOELLER, St. Petersburg.
,, Sweden and Norway	Dr. OTTO TORELL, Stockholm.
,, Switzerland	Prof. FAVRE, Geneva.

Council:

Messrs. BARRANDE, J., Prague, Bohemia.
BRIART, M.A., Pres. of the Geological Society of Brussels.
CHAMBERLAIN, Dir. of the Geol. Survey of Wisconsin, U.S.A.
COOK, G. H., Dir. Geol. Survey of New Jersey.
DEWALQUE, Prof. of Geology, Liège.
DIEULAFAIT, Prof. of Geology, Marseilles.
DUPONT, Dir. Natural History Museum, Brussels.
GIORDANO, Inspector General of Mines, Italy.
GOSSELET, Prof. of Geology, Lille.
HANKS, J., San Francisco.
HANTKEN, Dir. Geol. Institute, Hungary.
HELLAND, Delegate from Norway.
INOSTRANZOFF, Prof. of Geology, St. Petersburg.
JACCARD, Prof. of Geology, Neufchâtel.
LENNIER, Dir. of the Museum, Havre.
LORIOL, Geneva.
LORY, Prof. of Geology, Grenoble.
LUNDGREN, Prof., University of Lund.
MALAISE, Delegate from the Royal Academy of Sciences, Brussels.
MATHERON, Marseilles.
MAYER, Prof., University of Zurich.
MORIERE, Prof. of Geology, Caen.
PILAR, Prof. of Geology, University of Agram.
PIRONA, Delegate from the Institute of Venice.
RENEVIER, Prof. of Geology, Lausanne.
SAPORTA (Comte de), Corr. Member of the Institute of France.
SELLA, late Minister for Public Works, Italy.
SELWYN, A., F.R.S., Dir. of the Geological Survey of Canada.
SIRODOT, Prof. of Geology, Rennes.
WINKLER, Dr. T. C., Haarlem.

Secretaries—Messrs. BROCCHI, DELAIRE, SAUVAGE, and VELAIN.

Treasurer—A. BIOCHE.

General Secretary—A. JANNETTAZ.

The propositions specially laid down, and previously published in the programme, for the consideration of the Congress, were the following:—

1. The unification of geological signs (*i.e.* colours and conventional signs).

2. The discussion of various questions relative to the limits and characters of certain formations.

3. The representation of faults and veins.

4. The respective values of the fauna and flora in defining beds.

5. On the value of the mineral composition and texture of rocks in determining their origin and age.

Some thirty and odd papers bearing more or less closely upon the above propositions were read and discussed.

At the last meeting International Commissions were appointed to consider certain propositions, and to report upon them at the meeting to be held at Bologna in 1881. Three of the propositions are matters of the utmost importance to geologists; and if they be well and honestly worked out, the result should prove of the greatest use and benefit to Science.

1. The International Committee for the Unification of Geological Signs is composed as follows:—

For England	Prof. T. McKenny Hughes, Cambridge.
,, Australasia... ...	Prof. Liversidge, University of Sydney.
,, Belgium	M. Dupont, Dir. of Nat. Hist. Mus., Brussels.
,, Canada	Mr. Selwyn, F.R.S., Dir. Geol, Survey, Canada.
,, Spain and Portugal	M. Ribeiro, Dir. of the Geol. Survey of Portugal.
,, United States ...	Mr. Lesley, Dir. Geol. Survey of Pennsylvania.
,, France...	M. De Chancourtois, Ecole des Mines, Paris.
,, Hungary	M. De Hantken, Dir. Geol. Inst. Hungary.
,, Italy	M. Giordana, Rome.
,, Russia	M. De Moeller, University of St. Petersburg.
,, Scandinavia ...	M. Otto Torell, Dir. Geol. Survey of Sweden.
,, Switzerland ...	Prof. Renevier, Lausanne.

2. The International Committee for the Unification of Geological Nomenclature is as follows:—

For England	Prof. T. McKenny Hughes, Cambridge.
,, Australasia... ...	Prof. Liversidge, Sydney.
,, Canada	Dr. Sterry Hunt, Boston, U.S.
,, Spain and Portugal	Prof. Villanova, Madrid.
,, United States ...	Prof. J. Hall, New Jersey.
,, France...	M. Hebert, Paris.
,, Hungary	Prof. Szabo, Buda Pesth.
,, Italy	Prof. Capellini, Bologna.
,, Roumania	Prof. Stephanesco, Bucharest.
,, Russia	Prof. Inostranzoff, St. Petersburg.
,, Scandinavia ...	Prof. Lundgren, Lund.
,, Switzerland ...	Prof. A. Favre, Geneva.

3. The Committee appointed to discuss the rules to be followed in forming a system of nomenclature is composed as follows:—

For Palæontology—

MM. Cotteau, formerly President of the Geological Society of France.
Douville, Mining Engineer.
Gaudry, Pres. of the Geological Society.
Gosselet, Prof. in the Faculty of Sciences, Lille
Pourel, Member of the Senate.
De Saporta, Correspondent of the Institute.

For Mineralogy—

MM. Descloizeaux, Member of the Institute.
Jannettaz, formerly President of the Geological Society of France.

The members of these International Commissions are charged with the formation of local Committees in their respective countries; each Committee is to have the power to choose its own President and Secretaries.

The reports of the Committees are to be forwarded to the Central Committee at Bologna, by January, 1881.

This Committee is charged with the duty of printing and distributing these reports before the Congress meets in the October of that year.

The French Government has undertaken to print the proceedings and papers of the first session of the Geological and other Congresses (some thirty in number), held during the Paris Exhibiton.

The Geological Society of France threw open its rooms to the members of the Congress, not only during the actual week of meeting, but for some time before and after. Arrangements were made also for several very interesting geological excursions, which were well attended, and went off most pleasantly and successfully. The Honorary President, M. Bardoux, Minister for Public Instruction, held a reception at the Ministry in honor of the Congress—the President, Mr. Hébert, and the leading geologists residing in Paris, notably the professors at the University and the Ecole des Mines, likewise most hospitably received the members of the Congress at their official residences. These social gatherings formed a most agreeable part of the Congress, especially as the opportunity was taken at most of them of bringing under notice new specimens, diagrams, photographs, and other matters of interest.

A very useful feature in the arrangements for the Congress was the publication by the Organization Committee of a very full and valuable "Guide" to the Geological and Mineralogical collections at the Exhibition and various public institutions in Paris, as well as to certain collections belonging to private individuals. This book (Guide du Géologue à l'Exposition Universelle de 1878, et dans les collections publiques et privées de Paris), consisting of about 160

pages, described the principal features of the different collections; and the plan with which it was accompanied indicated with precision the exact positions within the Exhibition of the various collections interesting to the geologists. Without this "Guide" many of the collections scattered over the vast building on the Champ de Mars might easily have been overlooked even by the most careful. The book is divided into three parts; the first part treats of the Geological collections according to their range in time, or as it is headed—"Stratigraphical Geology," and was prepared by M. Hébert, with the assistance of several other members of the Geological Society of France. The notes have a special value, inasmuch as they are in each case signed by the contributor; the remarks made by M. Zeiller, upon the age of the specimens of fossil plants from the New South Wales coal beds, sent by Mr. Wilkinson, will doubtless prove of very great interest to the geologists of Australasia, and I therefore venture to quote them here.

Il nous semble nécessaire d'indiquer pourquoi nous rangeons ici dans l'oolithe les plantes de Queensland et de la Nouvelle-Galles du Sud, classées par M. Wilkinson, chef du service géologique de cette dernière colonie, dans le terrain carbonifère véritable (Upper Coal Measures).

Il est à remarquer que la plupart des géologues qui se sont occupés de ces formations ont été conduits par les caractères de la faune à les regarder en effet comme paléozoïques, et qu'au contraire, examinées au point de vue botanique, elles ont toujours été rangées dans l'étage oolithique. Elles reposent directement et en stratification concordante sur des couches dont M'Coy (Ann. and Mag. of Natural History, vol. XX, p. 155) les séparait dès 1847, et dont les fossiles indiquent en effet le terrain dévonien et le terrain carbonifère inférieur. On trouve également dans ces dernières couches quelques fossiles végétaux, d'abord à la base le Lepidodendron nothum, Ung., ou peut-être L. quadratum, Presl. (sp.), représenté dans la collection de la Nouvelle Galles du Sud par les échantillons nos. 36 et 48, et classé par M. Wilkinson dans le dévonien; ensuite, à Port Stephens, classées dans le carbonifère, avec des Spirifer, Productus, Euomphalus, etc., et dans les mêmes roches, diverses espèces qui correspondent bien au terrain carbonifère inférieur; nous citerons d'abord, de cette localité, un Knorria et des Lepidodendron peu déterminables, puis de belles empreintes étiquetées Otopteris ovata, dont l'une, représentée seulement par une photographie (no. 54), est accompagnée d'un Lepidodendron assez peu discernable, et qui nous paraissent être, non point des Otopteris, mais bien des Palæopteris, et, selon toute vraisemblance, le P. M'Coyana, Gœpp. (sp.); avec l'un de ces Palæopteris (no. 64), nous avons remarqué un Sphenopteris appartenant au groupe du S. dissecta; enfin un autre échantillon (no. 66) porte l'empreinte d'une fougère à pinnules très-divisées, qui pourrait à la rigueur n'être qu'un Palæopteris lacéré à la suite de la macération, mais qui cependant nous semble devoir être rapporté au Sphenopteridium dissectum, Gœpp. (sp.), qui est aussi du carbonifère inférieur.

Quant aux couches de charbon elles-mêmes, les empreintes qui en proviennent et qui sont rangées dans la Collection du Département des Mines de Sydney sous les nos. 140 à 175, avec le titre Upper Coal Measures, nous montrent les espèces suivantes : Vertebraria australis, M'Coy; Phyllotheca Hookeri, M'Coy; P. australis, Brgt.; P. ramosa, M'Coy; une Equisétascée à feuilles presque complétement soudées en une gaîne dentée, lâche, formant

un entonnoir très-ouvert, presque étalée, étiquetée Phyllotheca et qui nous semblerait plutôt appartenir à un Equisetum, Glossopteris Browniana, Brongt.; G. linearis, M'Coy (1); Sphenopteris hastata? M'Coy; et un Echinostrobus qui paraît être l'E. expansus, Sternb. (sp.) Le genre Phyllotheca, découvert en Australie, ne pouvait en 1847, à l'époque où M'Coy écrivait sa notice, servir de base à de déductions positives, puisqu'il n'avait pas encore été rencontré ailleurs; mais il a été retrouvé depuis lors dans les couches de Nagpur, aux Indes-Orientales, considérées comme oolithiques, et dans lesquelles on trouve aussi les Glossopteris, ainsi que le faisait remarquer M'Coy; et plus récemment M. de Zigno en a signalé dans l'oolithe du Véronais deux espèces très-voisines des espèces australiennes. Enfin, le genre Echinostrobus, qui, à notre connaissance, n'avait pas encore été signalé en Australie, est spécial au terrain jurassique, et l'E. expansus, que nous croyons avoir reconnu parmi ces échantillons, appartient, à l'étage inférieur, à l'oolithe de Scarborough.

Notons que les fossiles des "Upper Coal Measures," qui figurent dans les vitrines de l'exposition de la Nouvelle Galles du Sud, sont exclusivement des fossiles végétaux, et qu'on ne rencontre plus avec eux aucune des coquilles paléozoïques, Spirifer, Euomphalus, ou Productus, des couches inférieures; il y a bien, sous le no. 96, une empreinte de Glossopteris avec Phyllotheca, classée dans le catalogue par M. Wilkinson avec ces coquilles, parmi les Lower Coal Measures (Lower Marine Beds); mais cette empreinte est sur une roche absolument différente de celles qui accompagnent ces fossiles, et semblable au contraire au grès schisteux des "Upper Coal Measures."

Il nous paraît donc certain que ces schistes à Phyllotheca, Glossopteris et Echinostrobus, doivent être regardés comme tout-à-fait distincts des couches anciennes à fossiles marins et à Palæopteris sur lesquelles ils reposent, et dont ils seraient séparés par une lacune considérable, accusée par le changement profond qui s'est opéré dans la flore.

Le genre Phyllotheca se retrouve d'ailleurs encore plus loin dans la même collection en empreinte sur des roches semblables, et classé alors, sous le no. 179, dans le Trias, comme appartenant à l'étage de Hawkesbury et de Wianamatta que M'Coy rangeait dans l'Oolithe avec les couches à plantes.

Quant au Pecopteris de cet étage provenant de Clarence River, et classé sous le no. 180, il nous paraît appartenir plutôt au genre Dichopteris, qui est également jurassique.

Enfin, les empreintes de Queensland, exposées par M. Foote, d'Ipswich, sous le no. 230, comprennent les Sphenopteris elongata, Carr.; Cycadopteris odontopteroïdes, Morr. (sp.); et surtout, très-abondant le Pecopteris australis, Morr., qui présente avec le P. whitbyensis, Brgt., une ressemblance frappante. M. Daintree, dans ses Notes sur la Géologie de Queensland (1), distinguait dans les formations carbonifères de cette colonie deux systèmes, et classait le système supérieur, renfermant ces diverses espèces, dans les terrains mésozoïques, laissant au contraire dans le carbonifère véritable, avec les couches à Productus et à Spirifer, le système inférieur, caractérisé par les Glossopteris. Mais dans une note qui suit le travail de M. Daintree, M. Carruthers (2) discutait cette idée, et, séparant toutes les couches à plantes des couches à fossiles marins, concluait ainsi: "Mes recherches me conduisent à considérer les deux systèmes comme étant presque du même âge et à les ranger, d'accord avec Morris, M'Coy, Bunbury et Zigno, dans la période oolithique."

Nous ne pouvons, quant à nous, conclure différement, et il nous paraît que la présence du genre Echinostrobus dans les couches de la Nouvelle Galles du Sud vient encore confirmer avec plus de force l'opinion de ces savants paléontologistes.

The second part of the book treats of the collections according to their geographical distribution. This division was prepared by M. Velain, of the Sorbonne, one of the secretaries to the Committee of Organization. The third division of the book, devoted to the mineral collections and to mineralogical apparatus, is the work of M. Jannettaz, of the Sorbonne, who was General Secretary to the Congress.

Although we are nôt likely to have a large body of geologists present at the approaching Exhibition in September next, I think a similar guide to the geological and mineralogical collections at the Exhibition and in Sydney might be prepared with great advantage to those who possess scientific tastes, and also to the public at large. I hardly like to propose that a Geological Congress should be held, because the number who could attend would be such a small one; but the Royal Society of New South Wales might, perhaps, with advantage join with the other scientific Societies to hold some special meetings, at which papers could be read and discussed, after the model of the British Association.

The labours of the past and of the future geological Conferences should prove of peculiar value to the surveys now being conducted in Australia and New Zealand; for any general and international system of signs and colours which may be recommended by the Congress could be adopted here and in New Zealand with comparative ease, and at but little expense, inasmuch as the respective geological surveys are at present merely in their infancy. The extent of country at present geologically surveyed and mapped is quite insignificant, not so with many other countries: some have had large areas surveyed; in such, the cost of making a change in the printing of the maps would involve an enormous outlay.

The geological collections and publications sent from Sydney to the Paris Exhibition attracted considerable attention; the copies of the "Remarks on the Sedimentary Formations of New South Wales," by the late Rev. W. B. Clarke, F.R.S.; the "Mineral Map," and "Essay on the Progress and Resources of New South Wales," which at one of the first meetings were distributed to the members of the Congress, were received with great pleasure, and the President proposed, on behalf of the Congress, a vote of thanks in acknowledgment of the liberality of the New South Wales Government.

I much regret that as the papers read and discussed before the Congress have not yet been printed, I cannot, as I had intended, give you a condensed account of their contents and bearing, but I hope to be able to do so later on, when they shall have been published by the French Government.

The Organizing Committee for the next meeting at Bologna in 1881 is composed as follows:

Patron—His Majesty the King of Italy.

Honorary President—M. Sella, President of the Academy, Rome.

Messrs. Capellini, The Museum, Bologna.
Gastaldi, Prof. of Geology, Turin.
Taramelli, Prof. of Geology, Pavia.
Omboni, Prof. of Geology, Padua.
Meneghini, Prof. of Geology, Pisa.
Ponzi, Prof. of Geology, Rome.
Giordana, Chief Engineer of Mines, Rome.
Guiscardi, Prof. of Geology, Naples.
Gemmellaro, Prof. of Geology, Palmero.
De Pirona, Prof. of Geology, Venice.

The Italian Government and the Municipality of Bologna have offered their assistance in making arrangements for the reception and convenience of the members of the Congress during their stay in Bologna.

With regard to the Australasian Committees, with the formation of which I have been charged, I have merely to add that I hope to communicate with those interested in the subject at an early date.

Discussion.

Mr. Moore, F.L.S., supported the suggestion made by Professor Liversidge, that special Scientific Meetings should be held during the Sydney Exhibition, and that it would be highly desirable to have a conference of Botanists, to endeavour to settle the question of Botanical synonyms and nomenclature.

The Water of Sydney Harbour.

By Rev. W. Hey Sharp, M.A., Warden of St. Paul's College.

[*Read before the Royal Society of N.S. W., 4 August*, 1879.]

Introductory.—There are not wanting in the city of Sydney and its neighbourhood forcible reminders that the citizens have not yet successfully solved the pressing though unheroic problem of keeping their surroundings pure and wholesome. I have, however, no intention of meddling, except quite indirectly, with the difficult and expensive ideas suggested by the need of sanitary improvement. The question here asked and partly answered is a question of simple fact. Whatever may be the right way to cleanse the city and its suburbs, it is plain that at the present moment a large amount of impurity finds an obvious and easy outlet in the harbour. The observations recorded in the present paper were undertaken from a desire to ascertain to what extent the harbour is affected by this treatment. It is hoped that a sufficient apology for offering to the Royal Society of New South Wales such results as have been at present obtained may be found in the appeal for increased contributions from private members contained in the Vice-President's address at the commencement of the present Session.

Part selected.—The portion of the harbour hitherto examined is the irregular basin comprising Darling Harbour, Blackwattle Cove, and Rozella, White, and Johnstone's Bays. The group of inlets indicated by these names has an aggregate superficial area of about 1,800,000 square yards. Its shore-line is approximately eight and a half miles in length. The opening by which this exceptionally land-locked region communicates with the main body of the harbour is only about 400 yards wide. It will be seen that, from its great length of shore-line and its narrow outlet, the group of bays under review will be peculiarly liable to receive and retain impurities from the wharves, manufactories, and other accessories of a busy and crowded life, with which it is to a large extent surrounded.

Method.—For the present purpose the examination of a sample of water consists in determining the quantity of ammonia present in it in solution, and also the quantity of ammonia yielded by the destruction of the organic matter which it contains. There are thus two stages in the process. A measured volume of the water

is distilled in a glass retort, and successive portions of the distillate are examined for ammonia by means of the extremely delicate test known as Nessler's Reagent. This reagent yields, in solutions containing ammonia, a yellowish brown coloration, which varies in tint according to the quantity of ammonia present. It is thus possible, by means of pure water and a standard solution containing a known quantity of ammonia in a given volume of liquid, to imitate the colour produced by the water which is being examined, and so to estimate with great accuracy the amount of ammonia which it contains. The liquids for comparison are contained in tubes or cylinders of white glass, placed side by side upon a white surface. The depth of liquid being the same in each tube, a very slight difference of shade can be detected by looking through the liquids from above. The ammonia yielded in this the first stage of the process is termed "free."

When the distillate no longer shows signs of ammonia, the distillation is suspended until a solution of potash and permanganate of potash, previously well boiled, has been introduced into the retort. By this means, on continuing the distillation, nitrogen present in organic matter is converted into ammonia, and the quantity of this product is then measured as before by the Nessler test. This second yield of ammonia is distinguished as "albuminoid." The process thus slightly sketched is described in detail in Wanklyn and Chapman's book on "Water Analysis," and less fully in Thorpe's "Quantitative Chemical Analysis."

The results of this process are registered in terms of the litre as a unit of volume and the milligram as a unit of weight. It may be observed that a given number of milligrams per litre may also be read as the same number of parts per million. By means of the Nessler Reagent it is quite easy to measure so small a quantity of ammonia as the one two-hundredth of a milligram in fifty cubic centimètres of water, or in other words, one part of ammonia in ten million parts of water.

Standard of comparison.—The natural standard of comparison for the harbour water will of course be the water of the ocean outside. But before considering the water of the ocean, it may be well to instance the amount of ammonia, free and albuminoid, found in some samples of ordinary drinking water.

a. Drinking water.—It will be remembered that the month of May last was a time of heavy and continued rainfall. During that period I made three analyses of Sydney drinking water taken from a tap on the Newtown Road. The quantities of ammonia found in this water were as follows :—

		Free.		Albuminoid.
May 17	......	·014	......	·07
,, 22	......	·002	......	·068
June 5	......	·006	......	·065

Water taken from a large underground tank at St. Paul's College during the same period was found to be purer still—

	Free.	Albuminoid.
May 15	·00	·028
„ 21	·00	·03
June 2	·005	·03

It will be seen that both these waters were almost free from ammonia in solution; and that in the case of the latter at least, the quantity of ammonia yielded by organic matter was very small.

B. *Ocean water.*—To pass now to the water of the ocean. I have not had the opportunity of examining water taken from the open sea, or at any considerable distance from the harbour mouth. The samples analyzed were collected on the beach near Waverley. The results varied within small limits, giving from ·01 to ·03 mgrms. of free ammonia per litre, and ·03 or ·04 mgrms. of ammonia from organic matter.

Harbour water.—The difference between the ocean water and the water of that portion of the harbour with which we are here concerned was found to be very marked.

a. Blackwattle Cove.—To take first the neighbourhood of the embankment at the head of Blackwattle Cove. Samples of water collected near the western end of this embankment on May 22nd and 30th, at three hours' ebb, yielded free ammonia 1·7 and 1·13 respectively, and albuminoid ammonia ·72 and ·78. In other words, there was dissolved in these waters an amount of free ammonia from a hundred and ten to a hundred and seventy times as great as was found in an equal bulk of most of the samples of water from the beach at Waverley. It was soon apparent that this excessive impurity was due to a small creek running into the cove not far from the point at which the water had been collected. An examination of the water of this creek on June 6th showed that in spite of the copious downpour of rain during the previous four or five weeks it contained 4·35 mgrms. of free ammonia per litre, and ·61 mgrms. of albuminoid ammonia.

On June 2nd and 5th I examined water taken from points near the centre of the embankment. The former sample was collected two and a half hours before high-water; the latter about low-water. [There happened to be some eccentricity in the *Herald* tide notice on that day.] These samples, though differing considerably from each other, were both very much purer than those last described. The precise quantities of ammonia were as follows:—

	Free.	Albuminoid.
June 2nd	·24	·11
„ 5th	·42	·13

β. Glebe Point.—The peninsula of Pyrmont serves to divide the system of bays we are considering into two divisions, an eastern and a western. One more analysis was made of water collected from the shore of the western division. This was taken from Glebe Point on May 27th, about an hour before low-water. It yielded free ammonia ·25, albuminoid ·28.

γ. Wharf, Erskine-street.—On the eastern or Darling Harbour side of Pyrmont two samples were collected from the shore. Both of these were taken from a wharf at the foot of Erskine-street. The following results were obtained:—

	Free.	Albuminoid.
May 24th (half an hour after low-water) ...	**·66 ...**	**·11**
June 9th „ before high-water) ...	**·34 ...**	**·22**

The high-water sample yielded only half as much free ammonia as the low-water sample; but in respect to albuminoid ammonia the relation was exactly reversed. This may serve to illustrate the great variations and irregularity in regard to the amount of organic matter present in the harbour water.

δ. Glebe Island Bridge and Pyrmont Bridge.—It had now become apparent that water collected from the shore at different points, or at different times, varied very largely in its degree of impurity. This was naturally to be expected as the result of the uncertain distribution and varying character of local sources of disturbance. I thought, however, that water collected from the centres of the Pyrmont Bridge and of the bridge to Glebe Island would show a much more uniform character. The first trial from Pyrmont Bridge was made on June 2nd, at four hours' flood. Five days afterwards a sample of water was collected from the Glebe Island Bridge, about an hour and a half before low-water. The results of these two analyses agreed very closely together, being, in respect to free ammonia, ·58 and ·61 mgrms. respectively; and in respect to albuminoid ammonia ·26 mgrms. in both cases. This appeared to confirm the expectation of finding the water in mid-stream more uniformly mixed; but the apparent confirmation turned out to be purely accidental. On two subsequent days water was collected from both bridges at from two to three hours before high-water. The results for the western bridge were:—

	Free.	Albuminoid.
June 12	·26	·19
„ 17	·16	·06

Those for the eastern bridge were—

June 12	1·43	·2
„ 17	1·79	·84

Instead of the close agreement expected, we have here a contrast of the most pronounced and unmistakeable kind. Indeed, it happened, curiously enough, that the samples collected from the

two bridges were respectively the purest and the foulest which I have met with in this portion of the harbour. That taken from the Glebe Island Bridge was nearly as free from ammonia as a tolerable drinking water; that taken from the Pyrmont Bridge, though collected in mid-stream, was even more impure than the water collected at the embankment in Blackwattle Cove, in the neighbourhood of the polluted creek above described.

Conclusion.—I am not aware whether any similar examination of the water of the harbour has been previously made; nor do I pretend to know what degree of contamination in the water is likely to be injurious to those who live in close proximity to its shores. Whether the work above described has any interest or value beyond that of a private exercise in the use of an attractive method of analysis is a question which must be left for others to decide.

TABULAR VIEW OF RESULTS.

		Ammonia. (mgrms. per litre.) Free.	Albuminoid.
May	Sydney drinking water (mean of three) ...	·007	·067
,,	Underground tank at St. Paul's College...	·005	·03
,,	Ocean at Waverley	·01 to ·03	·03 to ·04
May 22.	Blackwattle Cove (3 hrs. ebb)	1·7	·72
,, 30.	,, ,, ,, ,, ...	1·13	·78
June 2.	,, ,, ,, (2½ hrs. before h.-w.)	·24	·11
,, 5.	,, ,, ,, (about l.-w.) ...	·42	·13
May 27.	Glebe Point (1 hr. before l.-w.)	·25	·28
,, 24.	Wharf, Erskine-street (½ hr. flood) ...	·66	·11
June 9.	,, ,, (½ hr. before h.-w.) ...	·34	·22
,, 6.	Foul Creek, Blackwattle Cove	4·35	·61
,, 7.	Glebe Island Bridge (5½ ebb)	·61	·26
,, 12.	,, ,, ,, (3½ flood)	·26	·19
,, 17.	,, ,, ,, (3½ before h.-w.) ...	·16	·06
,, 2.	Pyrmont Bridge (2½ b. h.-w.)	·58	·26
,, 12.	,, ,, (2 b. h.-w.)	1·43	·2
,, 17.	,, ,, (3 b. h.-w.)	1·79	·84

On the Anatomy of Distichopora—with a monograph of the genus.

By the REV. J. E. TENISON-WOODS, F.G.S., F.L.S., Hon. Mem. Roy. Soc., N.S.W.; President of the Linn. Soc., N.S. Wales, &c.

[*Read before the Royal Society of N.S.W., 6 August, 1879.*]

THE family of the *Stylasteridæ* has attracted so much attention lately in connection with the deep-sea dredgings, and the important researches of Mr. Moseley, naturalist to the "Challenger," that I need offer no apology for these brief researches on one of the least known of the family—the genus *Distichopora*. As far back as 1859 I sent specimens of this singular coral to naturalists in England, who could give me no information concerning them. The species sent home was described by Dr. Gray,* but beyond giving it a name and a brief description nothing was done. It was quite obvious that it must differ from every other kind of coral, but its peculiarities remained without explanation, and its relations or affinities unknown. From its appearance one would imagine that it was on the boundary-line between Polyzoa and Anthozoa, and indeed this was the origin of my interest in the solution of its anomalies. At that time I was becoming acquainted with the vast quantities of fossil polyzoa and corals in the tertiary formations of South Australia, all new to science, and belonging not only to new genera but families. The first step in their elucidation was to find out their connection with the living fauna. But I soon found that the living fauna was almost as unknown as the fossil. This led me to send many specimens to Europe, seldom, however, with any satisfactory result. I then saw that the work must be done, as far as it could be done, by Colonial naturalists.

One of my earliest puzzles was *Distichopora*. As early as 1858 I made some of the drawings which illustrate this paper, and I arrived at some of the conclusions which I embody here. As soon as I had seen the results of Agassiz's studies on the genus *Millepora* I came to the conclusion that *Distichopora* was one of those forms which, like the *Millepores*, belong more to the medusæ than corals. Relying upon the remark of Milne-Edwards, that the line of demarcation between these sub-kingdoms was the dermal organs of reproduction in the one case and the visceral organs in the other, I had already arrived at the supposition that the "*ampullæ*" were

* *Proc. Zool. Soc.*, 1860, p. 244.

the exodermal reproductive organs of *Distichopora*. I never had until lately an opportunity of studying the animals alive, and in the meantime Mr. Moseley had ably and satisfactorily decided the whole question in those brilliant researches which I shall refer to further on. After all that he has done, I consider the observations I have to offer here as a very trifling contribution to the stock of knowledge on the subject. Though they are original, there are few that will be new. During the long period over which my observations have extended, I have been enabled to work out the literature of the subject as I think pretty completely, and this, with the remarks on the new species I here introduce to science, will be all that I propose to add to what Mr. Moseley has given to the world.

The genus *Distichopora* was originally erected by Lamarck* for a coral which had previously found its place among the *Millepores*. It was described by Dr. P. S. Pallas in his summary of Zoophytes (*Elenchus Zoophitorum*) published at the Hague in 1766.† He placed it among his *Millepora*, which were thus defined: *animal vegetans, corallium, solidiusculum, ramosum, poris cylindraceas, in axin perpendicularibus, exserens.* This is the old Linnean definition, and included a very heterogeneous assemblage. The species referred to was mentioned by Rumphius in the *Herbarium Amboynense* (Amsterdam, 1750) as *Lithodendrum saccharaceum rubrum* (vol. vi, p. 243). Pallas supposes that the species he describes was meant, but as his is of a violet colour, which is very constant, Rumphius would have hardly designated his *rubrum*. It is much more likely that another species, *D. coccinea* or *D. rosea*, was designated by Rumphius. Pallas does not appear to have known them. The species he named *Millepora violacea*. The following is his diagnosis: *Masulæ corallina in rupibus diffusæ, assurgentes, ramulis teretibus, obtusis, subflexuosis, passim ramosis, verrucosisve, sesquipollicaribus. Substantia intus tubulis vasculosa, violaceo-albida, in superficie tenerrime scabra et sæpe pulcherrimo florum sambuci‡ colore tincta. Per ramulos extus suturæ vulgo binæ plerumque oppositæ, longitudinales, cellulosæ seu ex poris concatenatæ decurrunt. In quibusdam speciminibus observavi passim crebras in superficie bullulas, quales in adusto glutine fere surgunt; quæ confractæ cellulositatem latentem prodiderunt efflorescentiumque polyporum gemmulæ esse videntur. Locus: Mare Indicum unde cum* Iside *ocreacea et* Gorgonia suberosa *promiscue allatam habeo.*

* *Hist. Nat. d'Anim. s. Vertèbres*, 1st edit., vol. ii, p. 198.

† There were no plates to this edition, which is a small 8vo. Another was published in 1768 by Boddaert, at Utrecht, with plates. I have not seen any copy of it.

‡ The pale yellow of elder flowers is, I suppose, meant, though the simile is rather far-fetched.

Ellis knew the species, for he describes and figures it in his *Nat. Hist. of Zoophytes*, p. 140. MILLEPORA VIOLACEA. *M. in plano ramosa, ramulis ascendentibus, flexuosis, tereti impressis, sutura porosa, marginem ambiente.* He adds : "This coral is of a fine violet blue. It rises from a spread base about three inches high. Besides the line of large pores which surround the margin, there are two rows of small pores on each side of it. The surface when magnified is rough like shagreen, and here and there upon it there are clusters of little warts, like studs or bullulæ, which may probably be its ovaries. When the branches are broken across, there appears in the middle a row of three or four large pores surrounded by small ones. I had formerly a specimen of this coral from W. Webber, Esq., F.R.S., and very lately some complete ones from Mr. Banks and Dr. Solander, that the divers had fished up about the islands of the South Sea." There is no reference to any plate, but on turning to plate 26 we find a very excellent drawing (fig. 3), with a slightly enlarged fragment in fig. 4. In the accompanying letter-press it is stated that no explanation of this plate was found amongst Mr. Ellis's papers. Lamarck, with his usual accuracy, recognized the plate, and gives the following definition:—"*Distichopora.* Polypiary stony, solid, attached, branched, a little compressed. Pores unequal, *marginal*, disposed on the two opposite edges in longitudinal series, and in the form of sutures. On the surface of the branches there are a number of stelliform warts gathered in places. *Polypariam lapideum, solidulum, ramosum, fixum, compressiusculum. Pori inæquales, marginales, longitudinaliter seriati, saturam disticham mentientes. Verrucæ stellatæ, ad superficiem ramorum passum acervatæ. Observations.* I cannot avoid the necessity of separating from the Millepores the *Millepora violacea* of Pallas, and forming with it a distinct genus. This coral presents such singular characters in the form and in the disposition of its pores that although it is the only species known with this peculiarity, it is probable that others will be discovered of the same genus. Its characters equally remove it from millepores and retepores, and escharas, but its substance is more solid, and it cannot properly be placed amongst any of the genera with stony polypidoms. *Distichopora violacea. D. ramosa; ramulis ascendentibus, flexuosis, tereti compressis. Millep. violacea. Pall. Zooph.*, p. 258. Solander and Ell.,* p. 140. Habitat, Indian Ocean and Austral. My collection."

* The reason why no reference to the plate is found in Ellis's work is this: Ellis was publishing it with the assistance of Drs. Solander and Fothergill, the latter giving pecuniary aid. Ellis died Oct. 15, 1775, when the book was far on towards completion. Dr. Solander was then engaged at the British Museum, and could not do much alone. Dr. Fothergill died in 1780, and he was soon followed to the grave by Solander (in 1782). Urged by Sir Jos. Banks, the book was published in 1786, just as it was, by Mrs. Martha Watt, a surviving daughter of Ellis.

In Blainville's *Manuel d'Actinologie* p. 416, we find the following reference:—"Animal unknown, contained in cellules of two sorts, one stelliform, scattered, extremely superficial, and leaving few traces; the others poriform, deep, unequal, forming three lateral series on each side of the branches of a calcareous polypiary, dendroid, fixed, composed of compressed branches, obtuse, rounded, subflexuous, vasculo-tubulous in the interior. *D. violacea.* Lam., *Encyclo. Méthodique*, p. 481, No. 1, a b, Atlas (Atlas to the *Manuel d'Actinologie*, where the figure is a very poor one, though the general idea of the coral is more exact than that of Ellis), pl. 55, fig. 2. *Millepora violacea.* Linn. Gmelin, p. 3,785, No. 12. Red Sea and India.* Obs. This genus has been established by Lamarck for a polypiary differing from every known Millepore. In effect all its surface is covered with stelliform cellules, polygonal, extremely superficial, so as to be seen with difficulty, while on each side of the branches are round or oval holes, rather deep, disposed in three longitudinal series, those of the medium line being the largest † as the animals are lodged there. We cannot be sure of this, though it seems probable. What is certain is that the polypiary is extremely porous and scarcely solid." Blainville places the coral in the class Polypiaria, sub-class Stony Polypiaria, family Millepora. His observations are incorrect in two particulars—first in regarding the wart-like clusters as one of the kinds of cells; and secondly, as to the polypiary not being solid. Dana also mentions the genus in his *Synopsis of the Report on Zoophytes*, 2nd edit. New Haven, 1859, p. 15.‡ "Genus *Distichopora.* Lamarck. Ramose, quite small, branched in a plane. Corallum firm, branches often a little compressed, and a cellular furrow on two opposite sides extending over the extremity."

1. *Distichopora violacea.* Lamarck. Violet, with the tips a little yellowish; 2 to 2½ inches high and ramose; branches somewhat compressed, dichotomous, 1 to 1½ line broad. Plate 60, fig. 3, corallum nat. size; 3 *a*, extremity of a branch magnified. East Indies and Pacific, Paumotu, Archipelago.

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* This shows how little the habitats of the older authors can be trusted. I don't know where Blainville obtained his habitat. Ellis says the Pacific.

† Turton, in his translation of Gmelin, says this, but his description is extremely obscure in all but the habitat, thus—"South Sea Islands, about 3in. high, with two rows of small pores each side the margin, besides the line of larger ones surrounding it. Surface rough, with here and there clusters of little studs." Turton's Linnæus, vol. iv, p. 636.

‡ It must be borne in mind that the first edition of Dana's Zoophytes was the only one which had the atlas of plates, of which, unfortunately through a mistaken economy of the American Government, only 200 copies were printed. The Report on Zoophytes which accompanied it was a 4to volume of 750 pages, published in 1846. A second edition of this in 8vo. 172 pages, was published as above.

2. *Distichopora gracilis.* Dana. Reddish; more slender than the *violacea*, ramulous; branchlets one-third as broad, at summit about a third of a line. Plate 60, fig. 4, corallum natural size; fig. 5, a variety(?) natural size; 5*a* 5*b*, views enlarged. Paumotu, Archipelago.

Dana makes no further remark. It is rather singular that Milne-Edwards, in his *Hist. Nat. des Corallaires*, in which he refers to almost every coral and every author on corals known, makes no reference to this singular genus, nor to the observations of Pallas, Lamarck, or Ellis, except in the appendix, including it in the sub-class Cnidiares, or corals imperfectly known, or the affinities of which are doubtful. His observations are as follow :—Genus *Distichopora.* "Lamarck has established this genus for a very singular polypiary, which Pallas had described under the name of *Millepora violacea*, but which is known in only a very imperfect manner. The soft parts of this zoophyte have not yet been observed, and after the study we have made of the interior structure, there still remains much uncertainty as to the place it ought to occupy in a natural system of classification. Most naturalists consider it as belonging to the great division of *Madreporaria*, and in effect it has some points of resemblance with the *Favosites*, but in other respects it is very remote, and appears to me to have more analogy with the *Alcyonaria.* It has a dendroid habit, and is composed of almost cylindrical branches, somewhat twisted and nodulous, outspread on a vertical plane, and which presents, on the same plane at each side, a groove occupied by pores with an irregular contour. On making a vertical section, it is seen that these orifices are the termination of as many long tubular cellules, which are disposed in bundles and ranged transversely on two or many planes, as I have represented in the atlas of the great edition of the *Règne Animal de Cuvier* (Zoophytes, pl. 85, fig. 46). After being raised in an almost straight line, these cellules curve from both sides, so as to represent a kind of fan. They are nearly cylindrical at first, but open out gradually as they ascend. Towards the summit they become distorted by mutually pressing upon one another, and terminate by orifices, which are generally triangular and disposed in a single line at the extremity of the branches in two vertical lateral ranks. On the two opposite surfaces of the branches comprised within these series of openings the polypiary is thickened, and presents a very compact structure which is a little granulose. Finally, on the edge of the lateral groove, where the ends of the cells are disposed, one observes a series of little circular openings, which appear to be nascent cells analogous to the larger tubular cells already mentioned. There are only two species—one recent and the other fossil."* Mons. Edwards then describes the two

* *Hist. Nat. des Corallaires*, vol. iii, 1860, p. 450.

species. He says that the clusters of warts are not perforated, but they are so when old, but the perforation is generally at the side. He adds that his specimen came from the island of Timor. He also describes the fossil species noticed by Defrance in Michelin's *Iconographie Zoophytologique, Description des Polypiers fossiles de France, &c.* (Paris, 1847), p. 168, plate 45, fig. 11. I give a copy of Defrance's—or rather Michelin's—figure, which is evidently a *Distichopora* closely allied to our species in Australia. It is found at Chaumont (130 miles E.S.E. from Paris), in the Eocene Calcaire grossier, and in the same deposits at Vermandois. It is a thick-branched polypiary without warts; but the dots seen in the figure (fig. 16) show that it had them, but they are broken away, and form the areolar scars to be referred to subsequently. Defrance says of the fossil that, without knowing something of the soft parts of the animal, it would be in vain to discuss its analogies.*

Milne-Edwards refers to drawings of the sections of *Distichopora*, which I have not seen),† but I give here a figure (fig. 13) of a section of a new species—*D. livida, nobis*—which shows the fanlike structure to which he refers. It is very singular that the columella or style seems entirely to have escaped him. Had he noticed that, and its constant absence from the secondary pores in this genus, he would hardly have supposed that the latter were nascent calices.

I especially draw attention to the fact that a fossil species is found in the earlier formations,—a fact amongst many others which daily confront us of extinct European Tertiary species having living representatives in the Australian seas. In Polyzoan organisms we have another instance in the genus *Lunulites*. I have not been able to refer to the works of Schweigger (*op. cit.*), but it is not necessary, as he had no new observations to offer.

Dr. J. E. Gray described a new species of *Distichopora* in the *Proc. Zool. Soc.* for 1860, p. 244. His short paper on the subject is as follows:—

"DISTICHOPORA COCCINEA, n.s.—Coral, bright crimson, much branched, compressed; branches rather fan-shaped, expanded, placed on each side of the stem, the sides of the branches rather compressed; the main branches with a sub-central series of small compressed tubercles, like the commencement of new branches. Lateral pores narrow, cells small. The upper surface of the stem with many short furcate branches; hab., Pacific Ocean, near New Caledonia, in deep water. This species differs from the only other

* M. Edwards had also referred to the genus in his portion of the second edit. of Lamouroux, vol. ii, p. 505. See also Lamouroux, *Expos. Méth.*, p. 46, pl. 26; *Encyclop. Zoophyt.*, p. 256; Schweigger, *Beobachtungen u. Natür. Hist. Reisen*, pl. 6, fig. 61; *Handbuch*, p. 431.

† Except the copy in Mosely's Croonian Lecture.

recent species of the genus known, not alone in the beautiful bright crimson colour, but also in the form of the stem and branches, which in this coral is much more compressed, broader, and with shelving edges, giving it rather a sword-like appearance. The lateral grooves containing the cells are much narrower, the polypiferous cells much smaller. In one specimen, the small oblong, compressed tubercles in the middle of the upper side of the branches are produced into simple forked, or sometimes more subdivided short branches. The apices of the branches which have been broken and reproduced are whitish. The surface of many of the branches, as in *D. violacea*, is more or less crowded with convex circular elevations, or slight tubercles, which appear to be hollow or blister-like, with rather thick parietes."

In figure 8 I give a sketch of the coral, which I do not think has been figured before. I shall give a more minute diagnosis subsequently. I have seen no type specimen, but I think there can hardly be a mistake about the species. No other known to me has the peculiar lines of small branchlets running up the main stems in almost a linear series and jutting out at right angles from it. These always have pores through the centre, both gasteropores and dactylopores. The species is so very commonly met with that I am inclined to think it is to be found on the New South Wales coasts.

In the *Bulletin of the Museum of Comparative Zoology* (Cambridge, U. States) for 1868, I am informed that Count de Pourtales has given some observations on the genus *Distichopora*. I have not seen the paper in question; but in the *Proc. Zool. Soc.* for 1871, p. 281, Mr. W. Saville-Kent refers to an opinion given by the Count de Pourtales on the genus. He says that the structure of the calices in *Distichopora* is identical with what obtains in *Stylaster* and *Allopora*, with the exception that the calices are confluent. This structure is a tendency for the septa to unite and form with its loculi a ring of pores around the central chamber or columella (see fig. 15). In respect to the calices being confluent, he adds that *Distichopora* bears the same relation to *Stylaster* and *Allopora* that *Lithophyllia* and *Dasyphyllia* do to *Mussa* and *Symphyllia* among the *Astreidæ*, the latter having confluent calices, while the former have them always distinct.* Count de Pourtales further states that he considers *Distichopora* to be more closely allied to *Allopora* than to *Stylaster*. In this Mr. Saville-Kent differs from him, as he regards the lateral and serial disposition of the calices as indicating an origin from primary alternate distal rather than from an

* Prof. Verrill makes no distinction between *Mussa* and *Symphyllia*; the differences between them, he states, being dependent on the mode of growth, which may vary in the same species.

irregularly scattered gemmation. Mr. Saville-Kent then describes a new species, which he names *Distichopora rosea*. See *Proc. Zool. Soc.* 1871, *loc. cit.*

The wart-like clusters so frequently referred to are made one of the features for classifying *Stylasters*. M.-Edwards says of that genus that the branches have in various places clusters of vesicular tubercles. *S. gracilis*, *roseus*, *gemmascens* and *granulosus* all have them. Mr. Saville-Kent and others name them "ampullæ."

I am indebted to the Croonian Lecture* of Mr. Moseley, on the structure of the *Stylasteridæ*, for the following. Count de Pourtales, in his *Deep Sea Corals* (*Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College, No.* 4, 1871, p. 33), writes as follows:—"Professor Verrill first recognized the close affinity of *Distichopora*, *Errina*, and *Stylaster*. *Bull. Mus. Comp. Zool.*, No. 3, 1864.) In his notes on the *Radiata* (*Trans. Conn. Acad.* vol. I, 1870) he adopted a suggestion of mine to make a distinct family of the *Stylasteridæ*, which he places in his sub-order *Oculinacea*, both of us overlooking the fact that Gray had already established it. Pourtales, struck by the porous nature of the cœnenchyma of the coralla of the *Stylasteridæ* and other points in the hard structure which he observed, removed them from amongst the imperforate corals and ranged them next *Eupsammidæ*. He fully recognized many strong points of affinity which rendered the family a natural one, but failed to ascertain the true character of the organism, because he had not an opportunity to examine the soft structures."

Several other species of *Distichopora* were described from the Atlantic and West Indies by Prof. Verrill and Pourtales, as I gather from Moseley (*op. cit.*) thus:—*D. nitida*, Verrill Bull. Mus. Comp. Zool., Cambridge, 1, p. 46. *D. cervina*, Pourtales' *Deep Sea Corals*, p. 39, note, Ill. Cat. Mus. Comp. Zool., Harvard, No. 8, pl. 7, fig. 11, St. Thomas, Danish, West Indies. *D. foliacea*, Pourtales' *Deep Sea Corals*, p. 38, pl. 4, figs. 12, 13, off Florida and Key West, 100 to 262 fathoms. *D. sulcata*, Pourtales' *Deep Sea Corals*, p. 38, pl. 4, fig. 14, pl. 7, fig. 7, off Havanah, 270 fathoms, off Cuba. *D. barbadensis*, Pourtales, Ill. Cat. Mus. Comp. Zool., Harvard, No. 8, p. 43, pl. 7, fig. 10.

I have not had an opportunity of verifying any of these references or consulting the essays of Count Pourtales, but I have recently seen some of those of Prof. Verril.

All the preceding observations referred to the calcareous part of the coral. The soft parts of any of the *Stylasteridæ* were not even known to any observer except Sars†, who was enabled to see just

* See *Philosoph. Trans.*, Pt. ii, p. 425.

† *Bidrag til. Kundskaben om Dyreliret pad vore Havbanker, Forh. i Videnskabs. Selskabet i Christiana*, 1872, p. 115. Fide Moseley, *loc. cit.*

enough to make him suspect the affinity of the *Stylasteridæ* to the *Hydroids*. Ever since the observations of Agassiz on *Millepora* corals, by which they were identified with *Hydroids*, there has been a growing conviction that the *Stylasteridæ* were related to them. To follow the description of Mr. Moseley, in his charming Notes of a Naturalist on the "Challenger" (p. 526) the hard parts of the coral or calcareous skeleton of *Millepore* is finely porous throughout, and within this porous mass at its surface are excavated cylindrical holes or pores of two sizes. The porous mass supports the living tissue, which is a canal system or meshwork for circulation through the smallest part of the coral. Two kinds of polyps inhabit the two-sized pores. The larger are short, stout, cylindrical polyps, with four tentacles, a mouth, and a stomach. They are called *Gastrozooids*, and the pores they inhabit *Gastropores*. The smaller pores are occupied by a polyp with numerous tentacles, but devoid of mouth or stomach. They are called *Dactylozooids*, and the pores *Dactylopores*. All the polyps of the Colony are at their bases connected with canal system of circulation. Their mode of reproduction is not known. It is thought that they produce free-swimming Medusæ. It has been left to Mr. Moseley to be the discoverer of all the analogies of the *Stylasteridæ*, to which the *Milleporidæ* gave only an imperfect clue. During the voyage of the "Challenger" many new species and new genera of *Stylasteridæ* were dredged up, and though they were from great depths yet the tissues were living in some cases, and admitted of a complete examination. All the structures found a ready explanation. The two kinds of pores, the canal system, the ampullæ, and the serial pores all are found to be modifications of the one type, as following summary of the observations of Mr. Moseley will show.

In the *Stylasteridæ* there is a canal system or network of circulation. Gastrozooids and dactylozooids are present, consequently the two kinds of pores. In the gastropores there is usually a style or columella, and none in the dactylopores, but there are genera where the style is found in both, and others where it is found in neither. For the process of reproduction each colony or coral is of a separate sex, male or female. In the female stocks ova are developed in special chambers, which are the warts or ampullæ. The ova do not leave the ampullæ until they are developed into a cylindrical larva or planula, when it swims off and develops itself, when attached, into a new stock. The male organs are in ampullæ also, and contain spermatozoids. In some genera the pores are irregularly scattered, in others the dactylopores are grouped round the gastropores either irregularly (*Sporadopora*), regularly but few (*Allopora*), regular and numerous (*Allopora*, *Astylus*), few and in a linear series (*Distichopora*).

With regard to the reproduction, the influence or contact between the ova and spermatozooids has not been made out; indeed the whole question of reproduction in these, as well as *Anthozoa*, is obscure and unsatisfactory. The gonophore sacs within the ampullæ are called gonangia. The ova must be in some way impregnated within the gonangia, says Mr. Moseley, but this was not seen, nor has it been proved. In almost all *Hydroids* the sexes are on distinct stocks, and the tendency is always towards an alternate gemmation.

Like all other *Hydroids*, the surface layer develops *nematocysts* or receptacles for those coiled tubular threads which can be darted out when needed for purposes of offence or defence. In *Actiniæ* these are venomous in character. No triple-spined nematocysts such as those occurring in *Millepora* and in most *Hydroids* were detected as existing in any of the *Stylasteridæ*.

Mr. Moseley was enabled to examine the soft parts of *Distichophora violacea*. The dactylozooids were found to be stoutly formed, and attached to the bottom of the pore by a long muscular slip. The gastrozooids were short and cylindrical, with four small clavate tentacles. The gonophores were similar in structure to other *Stylasteridæ*; both male and female specimens were examined, the latter distinguished by the prominence of the ampullæ. In the males the ampullæ were invisible, from the surface being sunk in the tissue.

Since these discoveries of Moseley have placed the *Stylasteridæ* in a definite position, it remains to state what that position is, and thus come to the true zoological character of *Distichophora*. In this I follow first the general outline proposed by Ray Lankester.

Animalia. Grade 2. Enterozoa—Animals consisting of many plastids primarily arranged in two layers, surrounding a food-receiving cavity, the enterōn. Grade 1. *Cœlentera*. Enterozoa, in which the enterōn remains as a continuous cavity either simple or much ramified inextensive with the body wall. * Phylum 1. *Porifera*. Phylum 2. *Nematophora*. The latter are arranged in six classes, thus—1, HYDRO-MEDUSÆ. 2, PODACTINARIA. 3, DISCOMEDUSÆ. 4, HYDROCORALLINÆ. 5, ANTHOZOA. 6, CTENOPHORA.

The Hydrocorallinæ contain two orders, viz.—1, Petrosa (Stylaster, Millepora). 2, Graptolitidæ (Graptolites).

The synopsis of the genera is thus formed by Mr. Moseley.

HYDRO-CORALLINÆ (Sub-order).

Hydroids forming a corallum with two kinds of zooids, viz.—Gastrozooids and Dactylozooids.

Dactylozooids with numerous tentacles. Ampullæ absent. Fam. Milleporidæ.

* Phylum is a term proposed by Haeckel instead of sub-kingdom.

Fam. Stylasteridæ. Gray.

A. Pores sporadic or not in cyclo-systems. Gastropores with styles. Dactylopores without them.

AA. Dactylopores of one kind only.

Genus Sporadopora. Moseley, 1878.

Pores of both kinds simple. Gasterozooids with four tentacles. Polypora. Moseley, 1876.

Genus Pliobothrus. Pourtales, 1871.

Dactylopores at the tips of tubular projections. Gastrozooids without tentacles.

Genus Errina. Gray, 1835.

Gastropores sometimes covered with a projecting scale. Dactylopores within nariform projections.

Genus Distichopora. Lamarck, 1816.

Pores simple in a triple linear row at the lateral edges.

AAA. Dactylopores of two sizes.

Genus Labiopora. Moseley, 1878.

Larger dactylopores within nariform projections arranged in regular rows. Smaller dactylopores at the sides of these.

Genus Spinipora. Moseley, 1878.

Larger dactylopores within long spine-like projections. Smaller dactylopores in simple cavities at their bases. Gastrozooids with six tentacles.

B. Pores occurring in regular cyclo-systems only. Styles present in both kinds of pores or absent.

BB. Both kinds of pores with styles. Gastrozooids with tentacles.

Genus Allopora. Eherenberg, 1834.

Cyclo-systems budding from one another somewhat irregularly. Gasterozooids with twelve tentacles.

Genus Stylaster. Gray, 1831.

Corallum increasing by regular alternate gemmation of the cyclo-systems from one another. Gasterozooids with eight tentacles.

BBB. Styles absent, gasterozooids without tentacles. Gasteropores with two chambers.

Genus CRYPTOHELIA. Milne-Edwards, 1849.

Summits of the cyclo-system covered by a lid. Crypthelia E & H.

Genus ASTYLUS. Moseley, 1878.

Cyclo-systems without a lid.

In the definition which Mr. Moseley gives of *Distichopora* I think it necessary to make certain little additions or slight corrections after giving his words.

Distichopora. Lamarck. Corallum branching, flabelliform, with branches usually flattened in the plane of the flabellum, composed of very compact cœnenchyma. Pores confined to narrow lines or rows running along the exact edges of the sides of the branches, generally absent on their faces except as occasional abnormalities or rudimentary branchlets budding in a direction out of the plane of the flabellum. The lines of pores composed of three rows, a central row of larger gastropores with circular or oval mouths, and a row on each side of this of smaller dactylopores, sometimes very minute, often slit-like in aperture, the length of the slit being directed at right angles to the line of the row. Pores very deep, prolonged in curved lines side by side on the plane of the flabellum inwards and downwards towards the bases of the branches, forming thus throughout the flabellum a thin continuous tract of fragile tubular tissue, in which the successively developed curved pore tubes stand out fan-wise, separating from one another, the compact masses of cœnenchyma forming the opposite sides of the branches. The branches may therefore be readily split into two halves along the tubular track. Older gasteropores with immensely long filiform styles. Styles much shorter in the younger cells. None in dactylopores. Ampulæ sometimes on one, sometimes on both faces of the flabellum, prominent and often forming confluent masses.

The remarks I wish to add are that in all the species known to me, viz., *D. rosea*, *D. coccinea*, *D. violacea*, *D. livida*, the gasteropores are very irregular in shape, and vary extremely in size, being (in *D. violacea*) often quadrate or angular. They at times are studded with trabeculæ on the inside, see fig. 2, 3, and 10. The dactylopores are generally on a raised line and surrounded by a well defined wall and a row of smaller pores. See fig. 3 of a section. The pores round the dactylopores are very small and shallow. The styles vary much in shape. In *D. rosea* they are fine and feathery; in *D. violacea,* swollen towards the summit and covered with short spines, something like the thorns on a rose-bush; in *D. livida* it is very long and covered with irregular spinous processes (fig. 10).

I now give a list of the species, with a definition of those common in our seas.

D. nitida. Verrill.
D. cervina. Pourtales.
D. foliacea. Pourt.
D. sulcata. Pourt.
D. barbadensis. Pourt.
D. irregularis. Moseley. Sp. ind. postscript to Croonian Lecture, p. 502.

Distichopora violacea. Pallas. Corallum in tufts about (at most) two inches high and stained a pale bluish violet, nearly white at the tips, branching in a double antler-like manner. Branches almost cylindrical, but a little wider than thick, bifurcating two and three times. At each side the lateral furrow is broad, deep, and undulating. Margins of furrow very prominent—irregularly and finely dentate, sometimes extending in lobes on to the face of the branches. Surface finely granular—the granules larger than any other species here named; here and there studded with prominent, rounded, or roughly stellate excrescences. Gastropores contiguous, deep, sometimes alternating in size. Columella very long, thick at the summit, not visible from above. Dactylopores oblong, situated in the indentations of the raised margins.

Timor. Aneitum, N. Hebrides. J. Brazier; New Guinea; N. E. Australia, within the tropics.

Fig. 1. Coral nat. size. Fig. 2. Lateral groove much enlarged. *a*, gastropores. *b*, dactylopores on raised margin. Fig. 3, section of branch at margin a little more enlarged to show distinct wall round primary and secondary pores. *a* and *b* as before. Fig. 4, ampullæ much enlarged.

D. gracilis. Dana. *Descrip. of Zoophytes, op. cit.*, p. 151, pl. 60 fig. 4. Reddish, more slender than *D. violacea*, ramulous, branchlets one-third as broad, at summit about a third of a line. Paumotu Archipelago.

It is very difficult to recognize the species from this very imperfect diagnosis, so I have given the figures. Fig 5. Coral nat. size. Fig. 6. Lateral groove enlarged. Fig. 7. Portion of branch enlarged. All from Dana's figures.

D. rosea. Saville-Kent. *Proceed. Zoolog. Soc.* 1871, p. 281. Corallum arborescent, branches nearly cylindrical. Calices occupying deep and occasionally interrupted lateral furrows, margins of the furrows very prominent. Columella attenuate, stylate, echinate very deeply immersed, made visible by the fracture of the corallum. Height of corallum, one or two inches; diameter of calicinal furrows, one-twentieth of an inch; of the branches, quarter of an inch. Colour of the cœnenchyma, bright rose pink. Habitat, east coast of Australia. Brit. Museum.

The specific characters here noted are the raised margin to the lateral furrow and the colour. If I am right in my identification of the species, I may add that the surface is much more hispid than any other species, the pores smaller—the dactylopores especially. The ampullæ do not project much, and though lighter in colour are not conspicuous, and the branches often coalesce. It is not known outside the tropics.

D. coccinea. Gray. See *Proceed. Zool. Soc.* 1860, p. 244, *ut supra.* Corallum, five to six inches high, flabellate, spreading nearly on the same plane, a deep blood red, the distal ends often lighter in colour and fading into pale yellow. Branches broad and flat, very much compressed, never cylindrical, very finely hispid, studded all over with little wart-like branchlets, seldom more than two millim. high, but having primary and secondary pores. Lateral grooves, small, margins rounded, scarcely projecting. Gastropores distant, irregular, dactylopores minute. Style very minute, and fine ampullæ, cells paler in colour, not much raised but vesicular, numerous. Branches often coalescing, the distal ends very thin, flat, and often falcate.

N. East coast of Australia and Pacific. Though I have never found it on the N. S. Wales coast, I am inclined to think that it occurs there, as fragments are seen in almost every private collection of shells. Fig. 8. Corallum nat. size.

D. livida, nobis. See *Proc. Lin. Soc., N. S. Wales,* May, 1879. Corallum in stout solid tufts, three or four inches high, flabellate or twisted and gnarled, not always spreading in the same plane, very solid and compact, livid, the tip often yellow or white, the lateral furrows and the tips of the smaller branches orange or red. Branches almost cylindrical, stout, rugose, very finely vermiculate, many projecting branchlets, the central stem often disproportionately thicker than the branches and smooth. Lateral furrows conspicuous from their orange colour. Gastropores large, irregular. Dactylopores very small, situated on the margin, which is not much raised but broad. Style very long and spinous. Ampullæ in slightly swollen pale livid masses, in which the cells are not easily distinguished. When broken they leave deep areolar pits. Solomon Islands; New Hebrides; New Guinea.

Fig. 9. Corallum, nat. size.

Fig. 10. Gastropore with columella, much enlarged.

Fig. 11. Style (part of), highly magnified.

Fig. 12. Section near base.

Fig. 13. Enlarged longitudinal section of terminal branch, showing fan-like disposition of cells, styles removed, magnified.

Fig. 14. Transverse section of terminal branch, showing canal system between cœnenchyma cells, much enlarged.

Fig. 15. *a*, calices of *Allopora*, enlarged; *b*, single calice, highly magnified.

Fig. 16. *a* and *b*, *D. antiqua*. Defrance. Fossil species from European Eocene.

The following is a synopsis of the Pacific species :—

A. Branches nearly cylindrical.
- *a*. Marginal furrows much raised.
  - Colour, pale violet. *D. violacea.*
  - Colour, rose pink. *D. rosea.*
- *b*. Margins slightly raised.
  - Colour, livid with orange furrows. *D. livida.*

B. Branches compressed.
- *a*. Large, with lateral branchlets.
  - Colour, blood red. *D. coccinea.*
- *b*. Small, thin, smooth.
  - Colour, rose. *D. gracilis.*

[Two plates.]

Fig. 1

Fig 5

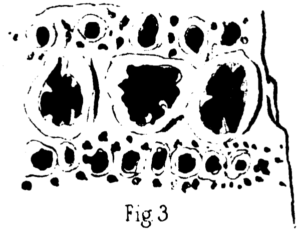


Fig. 3

Fig. 2

Fig. 4

Fig. 11

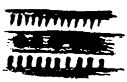


Fig 6

Fig. 7

Fig 9

Fig. 10

Fig 16

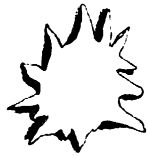


Fig. 12

Fig 13

Fig. 14

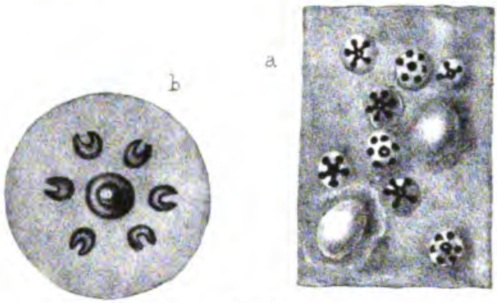


Fig. 15

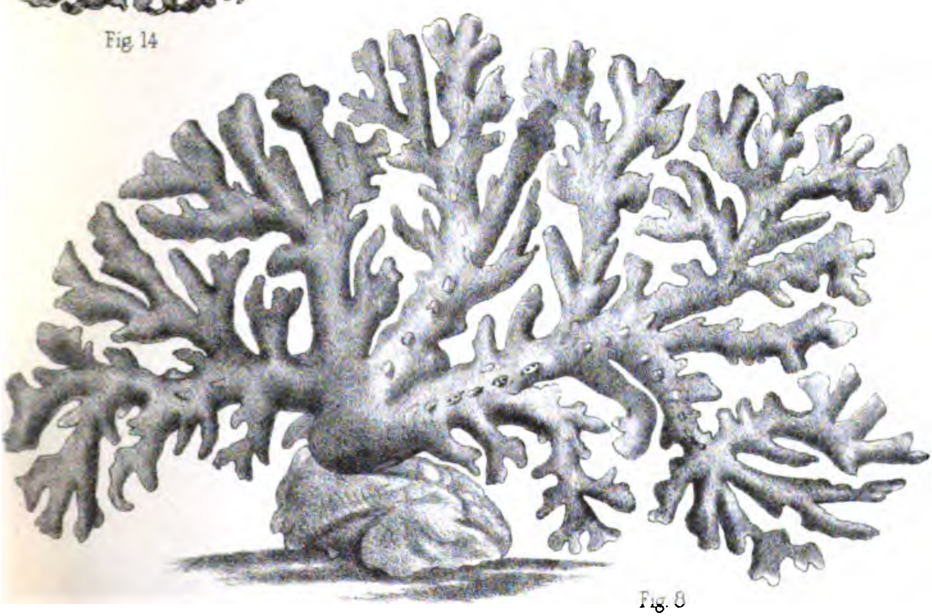


Fig. 8

On the Geological Formations of New Zealand compared with those of Australia.

A Lecture by JAMES HECTOR, M.D., C.M.G., F.R.S., Director of the Geological Survey of New Zealand.

[*Read before the Royal Society of N.S.W.*, 3 *September*, 1879.]

THE lecturer explained that his object was to describe the parallelism existing between the geology of New Zealand and Australia. Referring to a geological map of New Zealand which he had prepared for the Exhibition, on a scale of 12 miles to the inch, he described the configuration of the country, and showed that New Zealand presented a peculiar feature on the surface of the globe, as, notwithstanding its isolated position, its structure is highly complicated, in which respect it differs from that of most of the Oceanic islands. It is, in fact, the remnant of a large continent, which, formerly extending far to the eastward, had been reduced in area by the erosive action of the sea. There was reason to believe, from consideration of the existing and extinct fauna and flora, that the continent of which it formed part must have been connected in the temperate zone with South America. On the other hand, there was no clear evidence of its having been connected during tertiary times with Australia lying to the westward.

The surface configuration of New Zealand is that of a mountainous country, having a leading range composed of upper palæozoic rocks, but not of the older rock formations as might be expected. The mountain range commences on the south-east of Otago, sweeps round the west coast, where it culminates in Mount Cook, and reaches to Cook Strait. Thence it is continued through the North Island in a north-easterly direction to the East Cape. The rock formations of this backbone range have, on the whole, an easterly dip, and present a scarp to the westward, along the base of which, in the South Island, have been laid bare areas of metamorphic rock supporting synclinal masses of fossiliferous lower palæozoic strata, and in the North Island extensive volcanic outbursts, associated with vast tertiary formations. The investigations of the "Challenger Expedition" had also shown that, unlike other Oceanic islands, New Zealand is surrounded by a submarine plateau or shelf, which extends a varying distance from the coast. On the south-west the edge of this plateau almost coincides with the coast line, which here presents a massive buttress of granitoid rocks to the prevailing erosive action of the ocean from that quarter. To the eastward the extent of the plateau is unknown, except that it probably reaches as far as the Chatham

Islands. The depth of water on the plateau is about 300 to 600 fathoms, the surrounding water of the ocean having a depth of from 2,000 to 2,600 fathoms. Along the base of the mountains in the South Island are extensive plains of tertiary fluviatile formation, with occasional protruding ridges of upper mesozoic rocks forming low mountain ranges subordinate to the main axis. In the North Island there are similar outcrops of the mesozoic rocks through the marine tertiary and volcanic formation which occupy the greater portion of the surface. In many cases the evidence is very marked that in New Zealand the newer and unconsolidated formations have only survived and escaped denudation through the protecting influence of the harder masses of metamorphic and igneous rocks. This was illustrated by reference to the relation of the volcanic system of Banks's Peninsular to the Canterbury Plains, and of that of Mount Egmont to the great tertiary plain of the North Island. The period in which man first set foot in New Zealand, judging from the geological evidence and the most reliable opinions of ethnologists, could be distant probably not more than 600 to 800 years ago. There was ample evidence to show that in its primitive state New Zealand was almost entirely covered with forests. When the Maoris came they spread themselves rapidly over the whole country in pursuit of game, the principal of which was the moa,—a general term used for all the many species of large struthious birds which are now extinct. In their hunting expeditions, according to the traditions, one of their usual practices was to set fire to the bush, so that large areas were thus denuded of forest and became covered with ferns, grass, and shrubby vegetation. But there is no doubt that in some cases volcanic action also led to the firing of the vegetation and gave rise to extensive clearings in the interior of the North Island long before the arrival of the Maories. The forests being removed from the surface, then the loose detritus on the mountain sides that had been held formerly by the trees, being set free, descended to the low lands in large quantities, raising the river beds and turning them from the old courses into new channels, and giving rise to enormous alterations in the surface features of the country during a period which is contemporaneous with the most modern historical times of other countries.

After describing the condition under which human remains are found only in the superficial soils, while the moa bones are discovered not only along with the human remains, but also in the deep gravels, the lecturer left the introductory part of the subject, and by reference to a large diagram described in detail the geological formations, comparing them with what he considered to be their equivalents in Australia.

On the whole the geological record, so far as yet known, is more complete in the New Zealand than in the Australian area. The

tertiary strata are perhaps equally well developed, and the distinguishing facies of each existing fauna is discernible as early as the eocene formations. The upper mesozoic formations are very imperfectly represented in Australia, but have enormous development in New Zealand, in which country, as in America, the tertiary facies of the fauna and flora springs from a shore line and land surface of pre-cretaceous age. This is the period of the chief coal deposits in New Zealand.

But it is in the lower mesozoic period that the greatest divergence in the character of the deposits prevailed in the several areas. In Australia marine Jurassic formations, which can be determined by their fossils, are not extensively developed, while the characteristic fauna of the trias has not yet been detected; fossil plants, which are most uncertain guides, being alone found in the strata which must be referred to that period. In New Zealand, on the other hand, the three members of the marine formations have been distinguished by their abundant fossil contents. A liassic formation has a fair development, while an upper trias or Rhœtic formation has an importance due to thickness and variety of fossils which is unknown elsewhere. The trias with its very characteristic molluscous fauna is also largely developed, and also occurs in New Caledonia. Without any marked break the sequence in New Zealand passes down into a thick formation with permian fossils, but associated with forms found in the trias, while the more strictly palæozoic elements of the permian fauna are absent. This is followed in New Zealand by a gap, and the next formation, which is lower carboniferous and upper devonian, is the latest formation, according to our present evidence, which appears to have been common to Australia and New Zealand, and to have been deposited in both areas under the same physical conditions and within a common biological province.

The attempt to correlate the lower mesozoic formations in the two countries is therefore a matter of some difficulty; but as plant beds occur at intervals, interstratified with the marine strata of New Zealand, these may be perhaps yet employed successfully as indications of relative age.

This would be a most useful labour, as the strata concerning the age of which there is so much uncertainty, are of the highest economic importance in Australia and India, from their containing workable coal seams; but while the Upper Jurassic flora is well developed in New Zealand, and can be successfully compared with that of corresponding age in Australia and India, the lower plant beds of Rhœtic, Triassic, and Permian age have only yielded specimens in a bad state of preservation. The following attempt at a tabular comparison of the age of the formations in the two countries is therefore not made altogether on palæontological evidence, and is only the reading of the Australian record from the

the mountain range of a greatly extended land area, and when, in the North Island, the volcanic forces had their greatest activity, attended with the rapid elevation of local areas of fossiliferous deposits that were forming in adjacent seas. In the South Island no marine deposits of importance, belonging to this period, are present, but the great area of land above the shore line intensified the erosive action of the glaciers radiating from the mountain centres, and gave rise to enormous deposits of gravel, such, for instance, as compose the greater part of the Canterbury plains and the Montere hills in Nelson.

In the North Island this formation is, to a large extent, of marine origin, with 90 per cent. of existing mollusca, characterized by the great abundance of *Rotella zealandica*, with *Dosinea anus*, *Struthiolaria fraseri*, *Chione assimilis*, and a large form of *Buccinum maculatum*, with many other forms.

The economic importance of this formation is very considerable, from its containing the richest deposits of alluvial gold that form the support of the mining population. In both New Zealand and Australia the natural drainage system of the country had a very different arrangement during pliocene times from that now obtaining, the ancient river courses constituting the "deep leads" and "made hills" of the gold-miners.

III.—Upper Miocene.

a. Wanganui series.
b. Manawatu Gorge.
c. Castle Point.
d. Taerua and Ross.
e. Waitotara and Awatere beds.

These beds consist of a series of sandy and argillaceous strata, the distribution of which, and as a rule the mineral character, indicates that they were related to a closely adjacent shore line, as they often pass, almost suddenly, from coarse conglomerates into narrow strips of fine mud and clay, such as are deposited in the centres of deep channels and inlets.

The New Zealand seas have yielded about 350 species of existing shells, of which 120 have been found in this formation, together with 25 forms which are now extinct.

They are specially characterized by the occurrence of *Ostrea ingens*, *Murex octagonus*, *Fusus triton*, *Struthiolaria cingulata*, *Chione assimilis*, and *Pecten gemmulatus*.

The stratigraphical position and proportion of recent forms in the fauna of this formation indicate a similar period to that of the great shell-limestone formation of the South Australian Bight.

IV.—Lower Miocene.

a. Mangapakeha Valley.
b. Taipo, Awamoa, and Pareora beds.

This formation, which is distinguished from the foregoing chiefly by its fossils, is a calcareous and argillaceous formation, widely spread over the east and central part of the North Island and both sides of the South Island, and, when not removed by denudation, can be traced to an altitude of 2,500 feet above the sea. It represents a period of great depression, and the deposits are remarkable for the absence of evidence of volcanic activity in any part of the region, and for the abundance of marine life,—about 55 existing mollusca and 110 extinct species having been obtained from this formation, amongst which *Dentalium irregularis*, *Pleurotoma awamoaensis*, *Conus traileli*, *Turritella gigantea*, *Buccinum robinsoni*, and *Cucullæa alta*, are the most notable.

An equivalent to this formation in Australia appears to be found in the miocene strata of the Western district of Victoria, as exposed along the sea cliffs towards Portland, although the marked difference in species indicates these strata were deposited in distinct zoological regions.

V.—Upper Eocene.

a. Mount Brown beds.
b. Hutchinson's quarry beds.
c. Nummulitic beds.

This is a well-marked formation of calcareous sandstone, composed of shell fragments, with corals and bryozoa, and is a shallow water and littoral deposit.

Intense volcanic activity prevailed during this period in both Islands, and the calcareous strata are frequently interbedded with contemporaneous igneous rocks and tufas, and in the North Island are often replaced by wide spread trachyte flöes and volcanic breccias.

The lower part of this formation passes, at places, into an imperfect nummulitic limestone, or a friable calcareous sandstone, evidently deposited in shallow seas, and forming the lowest member of the proper marine tertiary series.

The more noticeable fossils in this formation are *StruthＯlaria senex*, *Pecten hutchinsoni*, *Pecten hochstetteri*, *Terebratella suessi*, *Meoma crawfordi*, *Bryozoa*, and numerous corals.

The Schnapper Point beds of Port Phillip, described by Professor M'Coy as oligocene, the Table Cape beds of Tasmania, described by the Rev. E. Tennison-Woods, and the Murray River beds described by Professor Tait, appear to be equivalents of this formation.

VI.—CRETACEO-TERTIARY.

a. Grey marls.
b. Ototara and Weka Pass stone.
c. Fucoidal greensands.
d. Amuri limestone, chalk marls, and chalk with flints.
e. Marly greensands.
f. Island sandstone (Reptilian beds).
g. Black grit and coal formation.

These constitute the cretaceo-tertiary group, being stratigraphically associated, and containing many fossils in common throughout, while at the same time, though none are existing species, many present a strong tertiary facies, and in the upper part only a few are decidedly secondary forms.

The distribution of this formation shows that it was not, like formations of later date, deposited in relation to the form of the land as at present obtaining in the New Zealand area, except in the vicinity of some of the oldest and most lofty land masses in the south, which appear to have remained above the water-line from the lower cretaceous period.

The upper part of this formation is a deep-sea deposit, but the lower subdivisions indicate the close vicinity of land, and are replaced in some areas by true estuarine and fluviatile beds containing coal.

The marine fossils include, besides well-marked greensand forms, such as *Ancyloceras*, *Belemnites*, and *Rostellaria*, a number that have still a marked affinity to the tertiary fauna. Saurian bones occur of the genera *Plesiosaurus*, *Mauisaurus*, *Leiodon*, &c., in this part of the formation, but they have only been found as yet over a limited area on the east side of the South Island.

The black grit, which is the lowest marine bed of this group, resembles in mineral character and the contained fossils, the carstone and calcareous greensand of England.

In the upper part of this formation the valuable building stone known commercially as the "Oamaru stone" occurs, which is a calcareous sandstone very easily worked, but which hardens when exposed to the weather.

The principal coal deposits of New Zealand occur in the cretaceo-tertiary formation, but always at the base of the marine portion of the series, in every locality where they occur. They always rest upon the basement rock of the district, marking a great unconformity and long persistent land area at this period.

Thus they are overlaid by the Leda marls in the Waikato, the fucoidal greensands at Wangarei, and by the island sandstone in Otago, and on the west coast of the South Island.

The coals immediately following the marine beds are everywhere hydrous brown coals, but on the west coast these rest upon

an immense formation of micaceous sandstones, grits, and conglomerates, in which are seams of valuable bituminous coal, and this lower part of the formation is possibly the equivalent in time of the lower greensand group.

The same fossil plants are found associated with all these coal deposits, and even those of highest antiquity abound in the fossil remains of dicotyledonous and coniferous trees of closely allied species to those represented in the existing flora of the country.

In the Malvern hills, where the strata overlying the coal contain abundance of lower cretaceous fossils, the dicotyledonous leaves are associated with *Alethopteris*, *Oleandridum* (*Tæniopteris*), and other forms that are prevalent in the underlying Jurassic beds. The same association takes place in the sandstones overlying the coal on the west coast.

It appears from this that the land surface preceding the great depression during cretaceo-tertiary times survived to a later date in the north than in the south of New Zealand, the beds overlying the coal there being generally of younger cretaceous age.

Unless it be in Queensland, no equivalent of this formation has been detected in Australia.

VII.—Lower Greensand.

a. Amuri group on east coast.
b. Bituminous coals on west coast.

These beds consist of green and grey incoherent sandstones, with hard concretions, and large masses of silicified wood.

This formation, which is confined to a few localities of limited extent, is very rich in fossils of the genera *Belemnites* and *Trigonia*, with a few saurian bones and large Chæmeroid fishes. Its typical development is at the Waipara and Amuri Bluff, but equivalent beds are also found on the east coast of the North Island in several localities, and they have a considerable development in the neighbourhood of East Cape, extending inland as far as Hikurangi. Very similar forms are described from Flinders River in Queensland, one very characteristic species, *Belemnites Australis* (Philip's), being identical.

VIII.—Jurassic.

a. Mataura series.
b. Putataka series.
c. Flag Hill series.

These beds, which are the youngest of the lower secondary formation in New Zealand, require mention under their several subdivisions, although on the map no distinction has been made between them.

The Mataura series consists largely of estuarine beds, marine fossils being absent or rare. It consists of dark-coloured marls and fine-grained sandstones, and contains the fossil remains of a number of plants, of which eight species have been recognized. Amongst the genera are *Camptopteris*, *Cycadites*, and *Echinostrobus*, *Tæniopteris*, *Macrotæniopteris*, *Alethopteris*, which connect these strata with plant beds of India, Australia, and Tasmania.

The Putataka series, which has its typical development at Waikato Heads as marlstones, is represented in southern districts by coarse-grained sandstones, which pass near the base of the formation into conglomerates with bands of indurated shale, enclosing plant remains and irregular coal-seams, which have been included in the next group as its upper member.

The Putataka beds are of marine origin, and contain fossils, of which eleven species have been identified.

The fossil plants found in the upper beds are especially interesting from at least one species being identical with a plant found in the Rajmahal beds of India, which are considered to be of liassic age; viz., *Macrotæniopteris lata*, with which several others are associated, but from the natural sections, and also from the very characteristic fossils below them, there can be no doubt that they should be referred to the upper oolite period.

The Flag Hill series is marine, and is characterized by eighteen forms of fossil shells which have been identified; besides many others which have yet to be examined.

The Brachiopoda are interesting, as besides seven forms of *Rhynchonella* and three of *Terebratula*, *Spiriferina rostratus* of the lias is abundant, and also a form of *Epithyris* (*i.e.*, a *Terebratula* of the type *T. elongata*), which is not hitherto recorded higher than of permian age.

Marine equivalents of this formation in Australia have only been found in Queensland and Western Australia, but the plant beds of the Clarence River, in New South Wales, and the Jerusalem Coal Field, near Hobart Town, appear to be the same.

IX.—Lias.

Catlin's River and Bastion series.

This formation consists in its upper part of conglomerates and sandy grits, with plant remains too indistinct for identification; and in the lower of marly sandstones in banded layers of different colours, at the base having a concretionary structure, which has led to their being termed the "cannon-ball sandstone," and similar sandstones also occur in the Otapiri formation.

Fossils are plentiful, and divide the strata into distinct horizons, *Ammonites* being especially common; fifteen species have been determined, but a large number of others are present which have not yet been identified.

The general facies of the fauna is on the whole liassic, although many lower oolite forms occur; but the Brachiopoda, of which twenty-one forms have been provisionally distinguished, again present the same abnormal survival of older types, especially in the occurence of an *Athyris*-like shell belonging to a new sub-genus, *Clavigera*, which has a great development in the next lower formation.

Nothing which corresponds to this formation has yet been found in Australia.

X.—Trias.

a. Otapiri series.
b. Wairoa series.
c. Oreti series.

It has been found necessary to include in this formation a thickness of strata which is quite unusual in other parts of the world; but the close connection which exists throughout, founded both on palæontological and stratigraphical grounds, and the clearly defined permian character of the next underlying formation, renders this classification absolutely necessary.

The Otapiri series consists of a group of strata which I place in upper trias, or more properly as an equivalent of the Rhœtic formation, and is remarkable for the mixed character of its fossils, which however contain many forms identical with those from the Rhœtic formation of the European Alps.

This mixed character is shown by the presence of *Belemnites otapiriensis*, which is near to *B. elongatus* of the English lias, along with *Pleurotomaria ornata*, and *Tancredia truncata*, which are oolite forms, associated with a preponderance of triassic and even permian forms, fourteen species of which have been determined, amongst which are *Nautilus mesodiscus* and *Nautilus goniatites*, cephalopoda, found in the Hallstadt or Rhœtic beds of Europe.

The remarkable feature of the Otapiri series is the abundance of Brachiopoda, which are elsewhere so rare in formations of this period, but, as might be expected, they are chiefly peculiar forms —*Clavigera*, which has seven species, representing the genus *Athyris*; and a sub-genus of *Spiriferina*, which I name *Rastelligera*, with five species, being almost entirely confined to this formation. Plant remains also occur.

The Wairoa series has been generally admitted to be trias since it was first described by Dr. von Hochstetter as characterized by *Monotis salinaria*, *Halobia lomelli*, &c. Eleven species have now been determined, and Brachiopoda are represented by the earliest appearance of *Clavigera* and *Rastelligera* a form allied to *Spiriferina*, but having the dental plates conjoined with the rostral septum (*Psioidea*), but these are very rare.*

In some districts the Wairoa series is divided into two horizons, yielding marine fossils, by sandstones containing fossil plants, from which forms of *Glossopteris* (?), *Zamites*, and *Rhacophyllum* have been obtained.

The Oreti series, which has been mentioned in the reports as the lower Wairoa series, has since been shown to be absent in the Wairoa district, so that it is advisable to give it a distinct name. It includes a great formation of green and grey tufaceous sandstones and breccias, having at its base a remarkable conglomerate of enormous masses of crystalline rocks, in a hard cementing matrix, resembling the character described for the base of the Gondwinda series in India. Some of the blocks, which are both angular and rounded, are 5 feet in diameter.

This conglomerate has a thickness varying from 50 feet to 400 feet, and is never absent from its proper sectional position in any part of the Hokanui District. The strata have been termed "ash-beds," on account of their tufaceous and brecciated character.

The fossils are chiefly permian and triassic forms, but a *Pentacrinus* also occurs, which resembles the Jurassic species. Brachiopoda are scarce, except one form of true *Athyris*, of which specimens are very abundant; with two species of *Psioidea*, and four species of *Rhynchonella* with smooth external surfaces, which only occur in collections from these beds in the Kaihiku Ranges.

The probable equivalents of this formation in Australia are to be found in the Wianamatta Shales and Hawkesbury Sandstones of New South Wales. Although both these are perhaps to a large extent of lacustrine origin, whereas the New Zealand beds are chiefly marine, there is nevertheless a striking similarity in the mineral composition of the strata. The absence of marine fossils from the Australian beds prevents any conclusive determination of this point; but the comparison of the fragmentary fossil plants, and the stratigraphical position of the formations in part support this view of their correlation.

* The Brachiopoda have a remarkable and characteristic development in the lower mesozoic formations of New Zealand, and descriptive notes of them will be given in a forthcoming volume of the Reports of the Geological Survey.

XI.—Permian.

Kaihiku series.

The mineral character of this formation is grey and green sandstone, with breccia and heavy conglomerate beds. Fossils have only been found at 1,000 feet below the great conglomerate that divides it from the Oreti series, the lower 5,000 feet not having yet been discovered to be fossiliferous.

The leading fossils are Permian species, of which a large number have been recognized, and the greater number, which have been found in Southland, also occur in Mount Potts and Nelson, where beds of the same age are present.

Saurian remains of large size are associated with these beds. They comprise vertebræ, limb bones, and ribs lying parallel; external to which are horny plates like dermal scuta. The vertebræ are circular, biconcave, and deeply excavated, so as to be almost perforated in the centre. The diameter of the centrum must, in some cases, have been 18 inches, and the length or marginal thickness of the disk 3 inches, so that the length to the width of the vertebral segments was 1 : 5. Still having the same proportions are other centra, but only 1 inch in length and over 6 inches in diameter. The articular surface of the bone is marked with irregular vascular channels, radiating from the centre, and the external surface of all the bones also shows this channelled character. No vertebral processes are visible. The ribs, which are strongly curved, are in some cases 3½ feet in length and 2¼ inches in diameter. The articular extremity is hatchet-shaped, with a convex surface. The proximal part of the rib looks like a hollow tube, probably owing to the spongy bone having disappeared, leaving the dense surface layer; but the distal portion of the rib for three-fourths of its length was solid throughout.

Thirty ribs were counted in one specimen, but it was not clear if they belonged to one side only.

The only limb bone available for examination is like the humerus of *Ichthyosaurus*, but greatly expanded at the distal extremity, being 11 inches in length and 9 inches across the lower end. It is compressed and concave on the one surface, and convex on the other.

The supposed scuta can only be seen in section; they are several inches in length and ⅛ inch in thickness.

Until these remains are in a better condition for examination, it is impossible to suggest the order to which they have an affinity.

It is worthy of note that, from a formation of the same age, near Nugget Point, Otago, and also in the Otapiri series in the Wairoa district, Nelson, teeth having *Labyrinthodont* characters have been obtained.

The occurrence of these saurian remains, together with the survival of many permian forms into the Wairoa and even the Otapiri series, and the absence of true *Spirifers*, *Productus*, and other usual palæozoic elements of a permian fauna, would seem to connect the Kaihiku series rather with the mesozoic than the palæozoic formations of New Zealand.

At the base of the Kaihiku series are the *Glossopteris* beds of Mount Potts, but these were not found in the Hokanui section, although from the thickness of the strata the relative beds must be included in it, while in the Kaihiku range *Glossopteris* occurs in the lower beds, as developed in the Popotunua Gorge.

The presence of this and other fossil ferns associates this formation with the horizon of the Newcastle coal measures in New South Wales, which is underlaid by marine strata at Stony Creek, on the Hunter, and at Wollongong, with a remarkable group of fossils. It is remarkable that no equivalent beds to the latter have yet been discovered in the New Zealand sections, there being a great break between the *Glossopteris* beds and the next formation.

XII.—Lower Carboniferous and Upper Devonian.

a. Maitai series.
b. Te Anau series.

This formation is of considerable importance from the large share it takes in the structure of the great mountain ranges, and from the occasionally great development in it of contemporaneous igneous rocks, with which are associated metalliferous deposits. In the upper part this formation consists of fine-grained argillaceous slates (Maitai slates of Hochstetter), becoming calcareous and passing into true limestones at their base. These limestones, which close the Maitai series, contain the following lower carboniferous fossils:—*Spirifera bisulcata*, *Productus brachythærus*, *Cyathophyllum*, and *Cyathocrinus*.

Succeeding these is the Te Anau series, which should probably be considered as upper devonian, but from the absence of fossils it has not been distinguished on the map.

It comprises an enormous thickness of greenstone breccias, aphanite slates, and diorite sandstones, with great contemporaneous flöes and dykes of diorite, serpentine, syenite, and felsite.

In Australia we have the undoubted equivalent of the formation in the Port Stephens beds, and in the calcareous diorites of Gympie, and probably in limestones, associated with greenstones south of Hobart Town.

XIII.—Lower Devonian.

Reefton beds.

These are determined by their fossil contents, and have only been distinguished in one locality, viz., Reefton, although from their mineral character they are evidently present in many other parts of the South Island.

They consist of alternating beds of quartzite, chert, and limestone, the latter yielding many fossils, of which a few species have been determined, such as *Leptæna bipartata*, *Orthis interlineata*, *Spirifera speciosa*, *S. cultrijugata*, *Chonetes striatella*, *Homalonotis expansa*.

The general character of the fossils from this formation compares with the limestone of the Upper Murrumbidgee, and near Carcoar and Bulubala, in New South Wales.

XIV.—Upper Silurian.

Baton River series.

A great part of the area coloured on the map as metamorphic schists should probably be included in this formation, but they have only been distinguished by their fossil contents in the north-west district of Nelson, where both Upper and Lower Silurian rocks are present.

The Upper Silurian rocks consist of grey cherts, sandstones, and calcareous slates, with occasional beds of blue limestones.

In the Baton River they contain a great variety of fossils in the calcareous strata, and not infrequently in the sandstones and cherts, of which thirteen species have been determined, besides which a great variety of corals and corallines occur ; crinoids also are very abundant.

Some few of the species are identical with those found in the lower devonian beds of Reefton, whilst others occur in the lower silurian rocks of America, but the prominent facies of the collections is undoubtedly upper silurian, *Orthis crassa*, *O. unguis*, *O. basilis*, *Spirifera radiata*, *Stricklandia lyrata*, *Rhynchonella wilsoni*, *Murchisonia uniangulata*, *Calymene blumenbachii*, *Homalonotis knightii*, being among the common species present.

Similar fossils are found in the limestones in Yass and Hume beds in N.S.W., and in the Gordon River limestones of Tasmania.

XV.—Lower Silurian.

Mount Arthur series.

These rocks form the mass of Mount Arthur, and the range to the north-east as far as Separation Point, and they consist chiefly of a dark metamorphic bituminous schist, associated with a blue

or grey sub-metamorphic limestone, which is in places developed to a very large extent. White crystalline limestones are also associated with these beds throughout the whole length of the district from Mount Owen to Motueka.

The whole series is disturbed by eruptive hornblendic and syenitic rocks, which are probably of devonian age.

Fossils have been found in two localities only, and these consist entirely of *Encrinite* remains, one species of coral not yet determined, and a few graptolites. The central axis of these beds consists of true mica schists, to the east and west of which the limestone and bituminous schists overlie. These strata have their equivalent in the auriferous slates of Victoria.

On the Languages of Australia in their connection with those of the Mozambique and of the South of Africa.

By HYDE CLARKE, Vice-President, Anthropological Institution, London, &c., &c., &c.

[*Read before the Royal Society of N.S.W.*, 1 *October*, 1879.]

IN Mr. R. Brough Smyth's great work—*The Aborigines of Australia* (Melbourne 1878)—there will be found in the second volume much matter on the Languages of Australia. Among these there will be found a very long vocabulary of the Yarra dialect, of the Yarra River of Melbourne, composed by Mr. John Green, Inspector of Aborigines.

Unfortunately many common words are left out, so that comparison can only be imperfect. However, I found on examination that it compares directly with a body of languages in Portuguese Africa, being class xi of Koelle's *Polyglotta Africana*, and comprising Muntu, Kirimau, Marawi, Meté, Matatau, and Nyambau, being the languages of Mozambique. The words outside of class xi are found in class x, being Bantu or Kaffre languages of Portuguese, Western and Central Africa, being Congo, &c. Some words are found in class iv, which is related to class x.

The following list will show this, the class x being thus marked—[ ]:—

	Yarra.	Africa.
Man	kolin (koli)	[akala, Mugentandu]
Woman	bazarrooki	[baketo, Nyombe]
	bajor	[badshento, Kabenda
Daughter	munggip	moanaka
Father	marmun	(mama, mother)
Mother	baboop	(baba, father)
Brother	bangganoo	pangiandenge
Sister	latingata	ndengetu
Eye	mee, merring	meso
Tooth	leeang	leeno
Navel	moondok	matoku
Knee	barreng	bondo
Bone	ma-lingo	likuwa
Skin	morrok	[mungoto, Lubalo]

	Yarra.	Africa.
Beak	barrgin-boon	poono
Knife	kal-been	mu-kalo
		mbene
Axe	karrgeen	koangoa
Spear	goeeon	[ngaya, Lubalo]
Stone	moojerr	moara
Coal	kanendurr	kala
Rope	woodel	[wondi, Mbamba]
Stick	kalk	[koko, Kabenda]
Leaf	jerrang	[jish, Bumbete]
Yam	barrm	[mbala, Kabenda]
Cat	bede-dil	[budi, Minboma]
Mosquito	gogook	[ngomgu, Mbanba]
Lizzard	tourroop	tabarrada
Little	wy-krook	[watola] [Kasanj] to-kieve, Bumbete
White	lam-borreen	[a-pfurau]
Black	woo-gar-ring	woo-ripa
Young	boop	[biop, Kanyika]
Warm	loom-badin	[a-domu, Melu]
Go	yani	[yami Lubalo]
Come	wandeat	uta
Cough	pooningoon	[ekona, Orangu]
Die	wykit	ukoa
War	ngatong	ngondo
		koto
Sun	ngumi	[ekombi, Bugela]
		[nkima, moon, Lubalo]
Moon	meene-an	[moanya, sun, Lubalo]
Sky	woorwarra	wa-moluku
Day	harremeen	[muini, Musentandu]
Night	booren	[buila, Kabende]
Rain	al	epula
Don	warrong	[ewuru, Sobo]
Fall	baderin	[buidi, Kabenda]
Sit	ngalimbe	Kala
Dream	yiock-gen	gona
Give	woonga	wunya
Cut	bundi	[batura, Kasanj]
Catch	banga-gat	[quata, Kasanj]
Two	bollo-ween	beli peli

To the Yarra model belong Kabi, Gunbower, Tyntyndyer, Glenorchy, Horsham, Upper Richardson, Balmoral, Hamilton, Wickliffe, Avoca, Daylesford, Goulburn, Witoure, Jajowrong, Kuen-koren-werro, Burapper, Ta-oungurong, &c.

As a further test, being the one Mozambique language answering to the Yarra, if we take other Australian roots we shall find their correspondents in the other languages of the Mozambique. Thus five roots for man and three for hair admit of being so compared.

The Echuca, Morcovia, and Sandford particularly show this, and the results are obtained from Moreton Bay in North Australia, New South Wales in the East, and from Western Australia.

The following table illustrates this :—

		Australia.	Kirimandi.	Africa.
Man	Echuca	moanit	moanna	Marawi
	Yelta	maalee	mulo	Kiriman
	Morcovia	nunna	nona	Nyamban
	Balmoral	beng	boana	Marawi
Head	Gunbower	moorun	muru	Kiriman
Hair	Wickliffe	marah	murit	Kiriman
	Yarra	yarro	ikarare	Muntu
	Gippsland	leet	lefu	Mutsaya
	Echuca	boka	[mbeta	Kisama]
Ear	Echuca	marrmo	maro	Matabau
	Yarra	wooring	nyaru	Marawi
Tooth	Echuca	derra	dino	Nyamban
	Sandford	tungung		
	Yarra	lecang	leene	Marawi
Mouth	Sandford	mullong	malagu	Meto
	Morcovia	moun	[munua	Kabenda
	Hamilton	kone	[li-kano	Lubalo
Sun	Bulloo	tuni	etana	Muntu, day
			[tangu	Kabenda]
	Yarra	ngume	[ekombi	Pangela]
Two	Moreton Bay	bullae	beli	Kiriman
	Yarra	bollo-ween	peli	,,
	N. S. Wales	pulla		
I	Victoria	ngie	ni Muntu	
		ngan	ne Nyamban	
	S. Australia	ngu		

It is very seldom that we can so distinctly lay down languages which are really related but widely distributed. There is, therefore no mistake that the language of the Melbourne tribes is of common origin with those of Mozambique.

A curious circumstance will be noticed,—that though the words may differ internally, they commonly begin with the same consonants in both continents. This serves to mark them, for in the class of languages to which they belong, the Bantu or Kaffre, the initial syllable is of great import.

This brings us direct to papers of great authority on the Bantu languages, by the late Dr. W. H. Bleek, contributed by him at the request of Professor Huxley to the Anthropological Society and Institute, and to be found in Vol. I of the Journal of the Anthropological Institute.

From the consideration of the grammatical points, Dr. Bleek was fully convinced that the Australian languages were related to the Bantu, and this he develops in a most remarkable paper on general philology.

Here, too, he examines what another great comparative philologist, Bishop Caldwell, had done in the Comparative Grammar of the Dravidian Languages, as to the wonderful identity of the Australian first personal pronoun with the Dravidian and some

other Indian languages. Caldwell was however unable to trace detailed resemblances. The observations of Dr. Caldwell are, however, as worthy of careful perusal as those of Dr. Bleek.

The latter was near seizing the whole truth as to the Australian languages, but missed, first from devotion to a theory he had laid down of six denoting languages as a type for classification. Next he failed from the besetting mania of philologists of regarding chiefly grammatical forms and disregarding words.

Were it not for these circumstances, Dr. Bleek, with his intimate knowledge of the Bantu family, must have identified the facts here given. Strangely enough, in the same volume of the Anthropological Journal is a paper and comparative table of Australian languages, by the Rev. Geo. Taplin, which contain the words.

Dr. Bleek recognized the connection of mythology with language, and the fact that the mythology of Australia is related to that of other regions.

The practices and culture of Australia are well enough known to present many features in common with those of the rest of the world, and the relation of an Australian mummy was only a few weeks ago illustrated by Professor W. H. Flower, at the Anthropological Institute.

In order to explain the ground on which the observations of Dr. Caldwell and Dr. Bleek rest, it may be useful to refer to those which were made by me on the 22nd November, 1870 (Journal, p. lxxxix). It results from the course of inquiry then instituted by me, that the Australian belong to a group of languages (and in this term I conform with Dr. Bleek) to which also belong the Bantu and the Dravidian.

These languages although developed in common and form the same sources, constitute a group. Thus the result is that roots may be differently selected in Australian Bantu and Dravidian, and will not fit in together in each case notwithstanding their common origin. The resemblance between the Yarra languages and the Mozambique languages is, as already stated, much closer than is commonly found.

It has been the opinion of some distinguished anthropologists that Australia is a centre of the human race, from which India and Africa were peopled. However, this may be, the facts now brought forward are, so far as language is concerned, in proof of the direct contrary. Africa, so far as this evidence is concerned, is the great centre of languages, of mythology, and of civilization.

As, in another paper contributed by me, High Africa has been treated on as a centre of culture, it is not necessary to go into the whole subject here.

The Australian languages will be found to belong to one of the earliest epochs of development of language in this group, but I am

of opinion that the testimonies brought forward in Mr. Brough Smyth's work, as to Australia having been at some former period under the influence of a white race, are correct.

As such, I should class, which I cannot now account for, though I have an hypothesis not yet tested, the curious circumstance that the names of languages in Australia are negatives. Now, a whole section in my Prehistoric, and Protohistoric Comparative Philology and Mythology is devoted to the exemplification of this remarkable characteristic of a negative series. Now one language is called the Kabi, and Kaba figures largely in many languages of the old world as a negative.

Mr. R. Brough Smyth, in the *The Aborigines of Victoria*, vol. II, page 8, (Trübner, 1878) says:—"A great many of the languages of Australia are named after the word 'no.' The late Mr. Bunce states that the Melbourne people used to designate their language by the words N'uther galla, N'uther meaning 'no'."

The late Mr. E. S. Parker corroborates Mr. Bunce's statement. He says:—"The natives distinguish the different table or languages by their negatives. Thus there is the Burapper dialect spoken by the Mallegoodneet ; the Utar dialect, on the Murray and Lower Goulburn ; these words, Burapper and Utar, being respectively the negatives of each language ; and so of others."

This system of nomenclature appears to prevail in the eastern and southern parts of the continent.

"The Rev. W. Ridley, M.A., eminent amongst the philologists of Australia, says the following are the names of some languages spoken in the interior :—"1. Kamilaroi ; 2. Wolaroi ; 3. Wiraiaroi ; 4. Wailwun ; 5. Kogai ; 6. Pikumbul ; 7. Paiamba ; 8. Kiugi. The first five of these are named after their negatives. In the first Kamil signifies 'no' ; in the second, Wol is 'no' ; in the third Wira is 'no' ; in the fourth Wail is 'no' ; in the fifth Ko is 'no.' In Pikumbul, on the other hand, Piku means yes."

Indeed the whole evidence is in confirmation of what has been stated by me (Prehistoric, Comparative Philology and Mythology, London, Trübner), that under the doctrine of the Four Worlds, taught in the School of Pergamos, the ancients preserved a knowledge of what was known to their predecessors in Babylon. The Austral world, which in the globe balanced our world, was Australasia, as in the other hemisphere the north and south worlds were North and South America.

Thus the knowledge of this intercourse was long lost, until now, we can restore a passage of many thousands of years old in the history of Australia.

Photography—its relation to Popular Education.

By L. Hart.

[*Read before the Royal Society of N.S.W., 5 November,* 1879.]

In a paper that I had the honour of reading before the members of the Fine Art Section of the Royal Society, in August, 1878, you will doubtless remember that I alluded to one particular application of photography, viz., its adaptability to popular education; and by this expression I mean not only those courses of instruction that are given in our national schools, but also the higher branches of science and art. Photography in its present state has become so influential and of such service, that there is now no more reason for trying to undervalue its utility than there would be for trying to ignore its very existence.

In making up this paper I have been obliged to have recourse largely to the various journals, English and foreign, devoted to photographic literature; and as I purpose at its close giving you some practical illustrations, I will curtail, as far as I reasonably can, the various opinions of others who are, like myself, doing their best to bring this art-science before the public in such a light that one and all must admit that the time has come when we can no longer deny it the prominent place it has so laboriously worked for, and admit it as one of the elements necessary for the better education of the popular mind.

I must presume that three things are admitted,—

1stly. That good education is not only useful, but necessary.

2ndly. That an elementary knowledge of the principles of science and art is conducive to the well-being of the human race.

3rdly. That one of the best means of imparting knowledge is by illustration.

Well then, I wish to show you that photography embraces the necessary conditions for the proper carrying out of these admitted facts. And to do so I must divide my subject into two heads, one treating briefly of some of the general applications of photography, and the other, to the particular mode in which it should be introduced into our public and private educational establishments.

We will take the first case. It it well known how, by means of photo-lithography and photo-engraving, a great impetus has been given to the production of good and cheap maps in all

civilized countries, and I mention particularly those countries where it has been taken up by their various Governments, in England, Austria, Belgium, France, Germany, Portugal, America, Australia, and even in some instances, Japan. I had almost forgotten India, where its services are largely brought into requisition, under the direction of that very practical gentleman Major Waterhouse. The most recent addition to this branch has been made in France, where a photographic establishment, under the direction of the Minister of the Interior, has been put up for the service of the Department of Roads and Bridges. This is in addition to those already in existence, and employed by the Land Survey Office, Public Instruction, Prisons, Bank of France, and other minor ones.

The French correspondent of one of our leading photographic journals writes from Paris of a meeting of the French Photographic Society, January 10th, 1879, in which he states "that Monsieur Curliez described a possible method of transferring to any required distance an image obtained in the camera obscura, with all the gradation of tones and half-tints, by means of an instrument similar to that used for the transmission of sound."

From an ordinary photographic negative a carbon positive or print in gelatine can be taken which will give an image in relief. By interposing between the negative and carbon a stippled plate, and exposing to the light for some time, an image would be obtained, formed of points or dots more or less deep, according to the intensity of the portions of the negatives through which the light had passed. By a simple mechanism a pin might be made to pass over these dots or points, and by means of a membrane, to repeat their gradation in the same way as Edison's Phonograph repeats the indentations which the sound vibrations have imprinted on the sheet of tin foil. For receiving the image the machinery employed would be exactly similar, and the vibrations of the pin could be transmitted to a distance by means of Bell's Telephone.

Another ingenious proposal of a useful application of photography is to establish a photographically-illustrated journal or newspaper, to be brought out weekly, and produced by means of one or more of the photo-mechanical processes now so largely employed, nor would it be a difficult matter to carry out this idea in a properly conducted establishment. Negatives received from correspondents abroad could be treated and made ready for the printers as rapidly as ordinary wood blocks can be drawn upon and engraved. It would be a waste of time here for me to dwell upon the value of such an illustrated periodical—the fact is too palpable—and certainly where sixpence and one shilling is given for an ordinary illustrated newspaper, double the price would not be refused for one of the kind proposed; and this brings me to another useful application, viz., producing such photographs on wood

blocks as can be engraved without the usual disagreements of such blocks, viz., a film on the surface of it. I am glad to state, in all modesty, that I have brought this application to a most perfect result since my sojourn here, but the engravers say that although there is but a shadow on the surface of the wood that it is very difficult to interpret. All the better; what we want in this age is not the engraver's interpretation of a subject, but a truthful one, such as is seen in nature, and therefore these gentlemen must do what photographers are doing—make themselves acquainted with the laws of nature and the rules of art—they will then have no difficulty in interpreting faithfully these valuable photographic drawings, and so the public at large will gain by having the eye educated to better work, and certainly more faithful than the great majority of drawings in the illustrated newspapers all over the world.

That these photo-mechanical processes are making great strides, not only as regards their own perfection, but also the eager manner in which they are being taken up by industrial establishments, does not admit of a doubt, and I say, without fear of contradiction, that the day is not far distant when no good printing establishment will consider itself complete without its photographic branch. Twenty years ago this might have been called a dream, but it is now becoming a staunch reality; and a great revolution is gradually taking place in our means of illustration by the mighty propelling power that photography is exercising.

The Paris correspondent of the *Photo News*, a few months back, says:—"Every day we who live in Paris are learning to appreciate more and more what photography in its different applications can render to science and art, and among these applications are especially to be noted those to printing in fatty inks, the establishments for producing which are constantly multiplying, and introducing improvements in their various methods of working." Another gentleman—Herr Kramar—speaks of the services photography is rendering physical geology, by proving the advance or contraction of different glaciers, and illustrated his remarks by showing photographs taken from Monte Rica, The Mouch, and the Jungfrau, at different periods from the same spot —viz., in the years 1863, 1873, and 1878—the heights of these varying from 6,000 to 14,000 feet above sea-level.

Nor has anthropological study been regardless of its services. A German publication, recently brought out, has been illustrated by some hundreds of photographic portraits of many distant tribes, and by which means, the author says, it is possible to classify the races in a far more intelligent manner than they had heretofore been done.

In Great Britain the Anthropological Society is endeavouring to make a collection of photographs of the different types of the human race.

Dr. Darwin used photography for illustrating his works. Dr. Haydon's collection contains no less than seventy different tribes of Indians by means of photography; in fact, it has become such an important aid to this study that the British Association has placed a sum of money at the disposal of its Committee, for the purpose of continuing the collection and publication of photographs of the different types of the British Empire. And might I not here say a word of regret that no public collection of photographs of the different races of Australasia exist—of those races so rapidly dying out, and who were not a hundred years ago undisputed masters of this now great country. I would that my influence were as powerful as my desire is to see this matter taken up, not by New South Wales only, but as an intercolonial work, and photographs of a regularly-adopted size and uniformity be at at once made ere it is irretrievably too late. The Colony of New South Wales possesses all the appliances necessary, even to the multiplication of prints by photo-mechanical means. It would be a source of great interest to future generations here, and of endless interest to the scientific world of other nations. Hitherto it has been an omission; let it not in the future be looked upon, when too late, as a fault.

In an article on the photographing of animals in motion, the *Times* remarks—"As one might expect, the art of instantaneous photography has thrown a good deal of light on certain problems of animal locomotion. Mr. Muybridge, of San Francisco, has lately obtained a series of photographs of horses in various modes of progression with great success. These experiments were made at the instigation of Governor Stanford, to whom the idea occurred from reading Professor Marey's remarkable work on Animal Mechanism. This latter gentleman also recommends that the same method should be applied in studying the flight of birds.

As an instance of the value of photographic records, I will only mention one,—its use by the Society of Naval Architects, and the British War Department, Woolwich. The subject of building armoured men of war has been recently rediscussed in England. Arguments that in years past proved delusive, and suggestions that have been tried and found wanting, have again been brought forward, and but for the photographic records of these experiences the Country would in all likelihood have been asked to go to the expense of repeating them. Fortunately the War Department has a photographic branch, and was enabled to bring forward the necessary proofs. This establishment does all its work by the carbon and fatty ink processes, and since its foundation has turned out upwards of 100,000 permanent photographs. From Woolwich to India is a long stride, but photography is as active in one place as in the other; for independent of its being used by the Indian Government, Dr. Hunter speaking of the progress of art in general

in India says: "I must inform you that photography is making very rapid strides in India. Many of the Rajahs and wealthy natives practise it with success, keeping assistant photographers in their pay." As I only intended to enumerate a few of the many applications of this art-science, to serve as it were as an introduction to my principal remarks, I must not continue longer on this subject,—suffice it to say that volumes might be written on the subject ere it would be exhausted. We will therefore pass on to consider "how it ought to be introduced into our schools."

For twenty years past I have been watching the gradual progress that has been made in the manner of applying photography, and now, after having visited the principal capitals of Europe, where, by some years of study and observation I have gained an insight into the requirements and desires of the scholastic world, I am fully convinced of the future importance that photography is destined to possess, as regards its application to public instruction.

Each year as it passed away left some distinguishing mark corroborative of my idea, and now I have the satisfaction of reading of results obtained, that I proposed to the French Government twelve years ago. My propositions were, and are still,—1stly, "to so vulgarize photography by means of lectures and courses of instruction in it as to make its principles generally known—and 2ndly, to apply that knowledge for the purposes of national education." Since my arrival in this country I have in no way abated in my endeavours to promote the advance of this interesting and important study; and success has partially rewarded my efforts, owing to the liberal manner in which I have been seconded by the Technical College in connection with the School of Arts. I mentioned that in France the matter had been well taken up. I will therefore refer you for a minute or two to the Paris correspondent of the *Photographic News*. He says—"Public opinion in Paris appears lately to have taken a turn in favour of the spread of, and (what is better still) of education in, photography. This may be taken as a good augury for the science, at length permitted to count as such, and to emerge with honor from the state of disrepute in which endeavours have persistently been made to keep it from its very start into existence up to the present."

Very little reflection helps us to appreciate the great services that photography can render and is rendering to science, art, and industry; nor can we discover that it is in any way injurious to any of them. However much these facts are known to those acquainted with the practical working of the art, it has yet to be made generally known and proclaimed to the world that it is the skilful handmaid of and not the rival of art and science.

The Scientific Association of France has been the first to do this in a thoroughly complete manner, by asking the veteran Davaune

to lecture at the Sorbonne; and what a splendid success was that first important lecture on Photography in this great centre of learning, and whose threshold it had never yet crossed, except as a servant—but now it had risen to claim its own; and to whom did it address itself? I will continue the paragraph:—"Among the audience were scientific men, members of the Academy, professors of the University, distinguished artists, and men of the world known for the extent of their knowledge and the depth of their learning."

All these were present as at an elementary school, to listen to truths of which they knew but little, and admire results whose causes they never would have guessed at. And all honour is due to the admirable spirit shown by the various establishments employing the different photo-mechanical processes; each one came forward to assist the learned Davaune by exhibiting the particular process in use in their establishments. Thus, photo-lithography, Gillottage, heliotype, Woodburytype, photo-engraving were passed successively in review. It was felt that the time of emancipation had come; heretofore its services had been largely availed of but little recognized. Artists called it a science, scientific men called it an art. Photographers themselves called it an "art-science," and the public at large know too little of it to give an opinion; but now, by the force of its own great power and truth, all are obliged to acknowledge its position as the art-science of photography. This brilliant change was followed up by a lecture at the Central Union of the Fine Arts applied to Manufactures "On the application of Photography to the Industrial Arts." Then came a course of lectures on photography at the "National School of Decorative Art," and a petition has since been made to the Minister of Public Instruction that a similar course may be delivered before the "Training Institution."

And now, how can this knowledge be applied or introduced into our public schools? Firstly, by means of the photo-mechanical processes, which will procure for each school a collection of such photographs as will not only serve for illustration and instruct, but at the same time as a useful ornamentation, by bringing constantly before the eye and mind works of refinement and art, and so gradually but surely laying the foundation of a natural taste for the good and beautiful. I cannot help quoting the words spoken by His Excellency Lord Loftus, at a speech delivered at Parramatta at the beginning of this month. He remarks, "Nothing so elevated and refined the minds of the young, and even softened their character, as the contemplation of the beauties of Nature, and of the objects of science and art. It not only elevated their nature, but at the same time it implanted in the youthful heart that spirit of ambition that led to highly valuable results." These are noble words, and worthy of great consideration

from all of us, but especially from those who are more immediately connected with the education of the youth of this country. Now of all kinds of tuition, that instilled into the mind by means of illustration is acknowledged to be the best. The inspiration (if I may use the term) received by its means is vivid, and more lasting than by other methods. The object of illustration is not to supersede the information given by the instructor, but to facilitate his task by bringing before his pupils in, as it were, a living form, the object of his remarks; it is supposed to be an embodiment of his teaching, and, as such, ought to be of the best description.

Now, I claim for photography the power of producing these illustrations in a manner superior to all others, in a pleasing, instructive, and, above all, truthful manner, and I think that the method I propose explaining to you will speak for itself, and require little advocating from me. It is simply photographic transparencies thrown upon a screen in an enlarged form, and illuminated by a powerful light, depending upon the quality of the slides used and the size of the image required. In speaking of a collection of views of Cyprus, by Mr. Thompson, a critic observes :—"These photographs are admirably adapted for book illustration, but they convey a far better idea of reality when employed as transparencies for throwing upon a screen." It is surprising how much there is in a photograph when seen in this way. Microscopic details, which the eye fails to perceive, are brought to view in a most striking manner, and we know what truth they contain. I think it is a most agreeable thing to be able to sit down comfortably and see pass before you scene after scene. Will you pass half-an-hour in China, Japan, India, Egypt, the ancient cities of the world, or see the most modern of architecture, the wonders of the microscope, the beauties of botany, rare and choice works of art, or indeed of any of the thousand and one subjects that might be mentioned, and yet how little has this power been used to assist in dissipating the large amount of ignorance existing among us.

In a well-written article in the *Photographic News*, on "Photography as a means of popular instruction," the following remarks occur :—"Wherever photography penetrates, there it irradiates, as if to prove that, owing its origin to light, it is called upon to diffuse light." It then goes on to say what is now being proposed to the French Government, viz., "to organize public courses of lessons (illustrated by the means already spoken of), not only in the school, but also in the public halls."

The plan proposed is "that each locality provide its own projection apparatus." This, in a wealthy and important centre, would be a powerful one, and in the case of less important places, some less powerful apparatus would be chosen, more easy and

economical to work. The views would be provided by the Government, consisting of geography, natural history, geology, botany, travels, history, music, &c., &c. These series would not only serve as illustrations for scholastic purposes, but also as recreation for grown-up persons. I need not insist on the immense value of these soirées. One of the greatest aims of our lives is to receive knowledge, the next should be to impart it—to use every available means to combat ignorance and superstition. Our International Exhibition is bringing us into a close connection with foreign nations. How many, aye, how very many of our fellow-creatures are there that only know of foreign countries by the absurd, and for the most part unreliable rumours of persons as ignorant as themselves. Here then is a way of giving truthful illustrations of any country,—its physical geography, manners and customs of its inhabitants, in short, of knowing all about it. How narrow and little are our ideas if we only know of ourselves and then as we see each other; we want to see the value of other nations, find out their best points and take them to ourselves. In this manner our mind will expand, we shall be able to judge more impartially, and our actions will be marked by liberality; our whole nature will gradually be changed, and by a constant wish to learn, we shall imperceptibly put in practice the knowledge obtained, to our own satisfaction and the great benefit of all around us.

Ottelia præterita, F. v. M.

By Baron von Müller, K.C.M.G., M.D., P.H.D., F.R.S.,
Government Botanist, Victoria.

[*Read before the Royal Society of N.S.W., 5 November, 1879.*]

Leaves large, from a roundish blunt base, oblong-elliptical; their midrib prominent; their lateral nerves spreading rectangularly, forming with the longitudinal nerves large, regularly quadrangular, tesselated areoles.

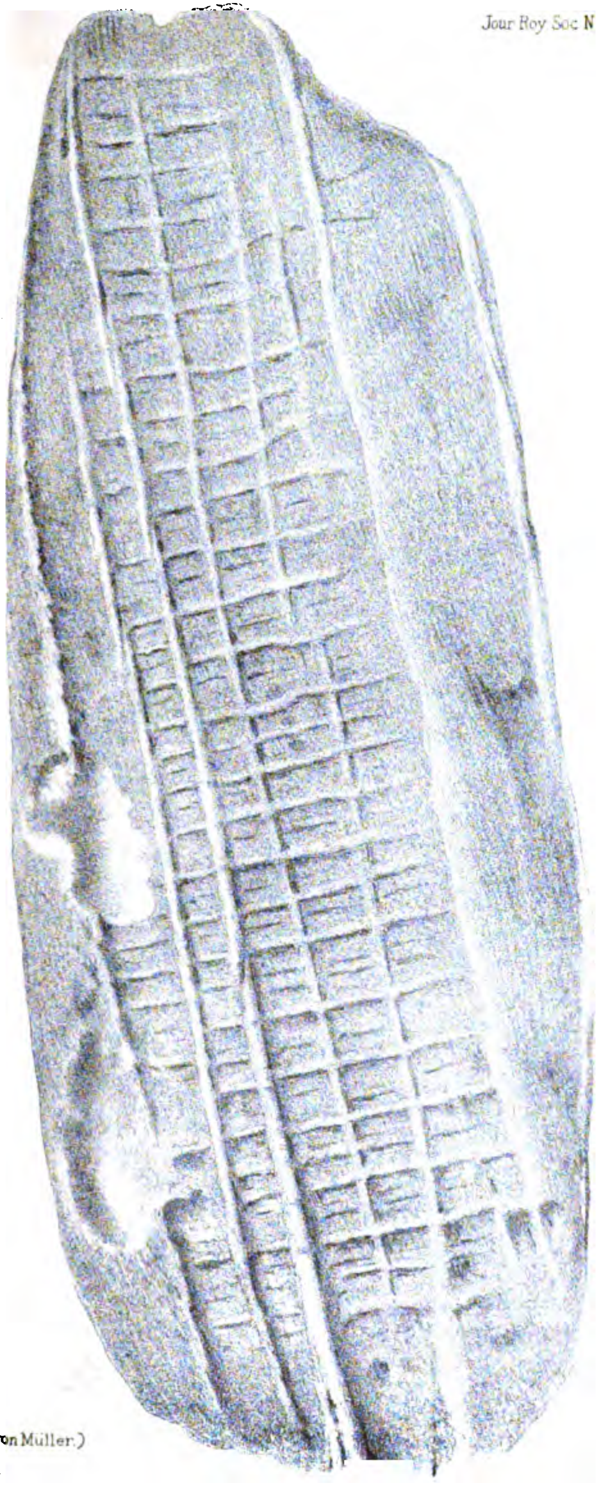
Under the above palæontographic designation it is here ventured to define the remnants of a solitary leaf-impression, kindly submitted by Professor Liversidge, of the Sydney University. Though from a mere leaf no absolute generic definition can be derived, either in this or in most other instances of descriptive classification, yet the general usage (often too hastily adopted in palæontography) may justify, also in this case, the choice of a temporary name for this certainly remarkable and conspicuous fossil. It is with less hesitation, that to this scanty remnant of a by-gone vegetation now a systematic place is assigned, because the testimony of its phytographic position points to a small group of aquatic plants, the Hydrocharideæ, and perhaps also the Alismaceæ, of which hitherto very few fossil species are on record. Among them Count de Saporta has noted already the leaves of one Ottelia, as those of *O. parisiensis* (Schimper, *Traité de Paléontologie végétale*, ii. 442) from the eocene limestone of the environs of the great French metropolis; besides, Professor Lesquereux, in the Reports of the United States Geological Surveys, 1874, p. 300 et 1878, p. 98 pl. LXI. fig. 8, rendered known the impression of a calyx of another Ottelia, described by him as *O. americana.*

When already so many other instances are known of plants to occur of prevailing or even exclusive Australian type (such as Casuarinæ, various Proteaceæ, &c.) among the tertiary fossils of Europe, though there no longer represented by any living forms, we must be less surprised to note here as well as there, probable fossil species of genera of now wide exotic range, among them such as may well have belonged to Ottelia. Nevertheless, the fruits of the Parisian species, as well as its Australian supposed fossil congener, remain yet unknown, to render their exact systematic position indisputable. The degree of variability of these plants

as regards the size of their leaves has been likely as large in former ages as it is at the present day, the two Australian living species being particularly remarkable in this respect. The length of the leaves of *O. parisiensis* is given as ranging from fourteen to fifteen centimètres ; the only impression available of *O. præterita* shows the leaf nearly twice as long. Diagonistically, little can be said about the latter species by mere comparison of the leaves, to discriminate it from some congeners of the living creation. In foliage it is nearly allied to our native *O. ovalifolia* (Cl. Richard, in *Memoir de l'Inst. de France*, 1811, p. 78), but the leaves of the latter are hardly ever so large, indeed usually much smaller; the midrib is not so prominent, the areoles are also smaller and less symmetrically quadrangular. Impressions of the bracteolar involucre and fruit of *O. præterita* may turn up yet to carry these comparisons still further.

NOTE.—Mr. F. H. F. Griffin, of Richmond, N.S.W., to whom the University is indebted for the fossil impression, informs me that he believes the specimen came from the Green Bush Quarry, on the Kissing Point Road, near to Parramatta. Phyllotheca and Gleichenites are also found in the Hawkesbury Rocks, together with fragmentary vegetable remains and leaves enclosed in the interbedded masses of Wianamatta shale.—A. LIVERSIDGE.

[One plate.]



...tella præterita, (von Müller.)

¾ Nat. Size.

A Liversidge, ...

Compiled Catalogue of Latitude Stars. Epoch 1880.

By H. S. Hawkins, M.A.

[*Read before the Royal Society of N.S. W.*, 3 *December*, 1879.]

Whilst I was engaged in preparing a programme of latitude stars, to be used for the determination of the position of the boundary between New South Wales and Queensland, it occurred to me, that, from unforeseen circumstances, the declinations of the B.A.C. stars required for zenith pairs might not be satisfactorily ascertained at the Sydney Observatory by the time when they would be required by Mr. Conder; whilst it was, of course, necessary that the latitude of the initial point should be accurately determined before he left it. This difficulty does not exist when, in the course of the trigonometrical survey, observations are made for latitude, since the data can be used at any time. Accordingly, when making out a list, after all the available stars have been selected from the Melbourne catalogue of 1870, it has been our practice to take the remainder from the B.A.C. catalogue of 1850, and to send them to the Government Astronomer for observation.

With but few exceptions, the positions given by the former catalogue are proved, by the coincidence of the deduced results, to be very accurate; whilst the errors of the latter are so numerous, and, when compared with the limit of error of Mr. Conder's observations, so great, that, even when the resulting latitude agrees with that found from more trustworthy data, no value can be attached to the coincidence until the positions of the stars have been verified.

In order to meet these difficulties, I began to collate the Melbourne and Cape catalogues, with the hope that I might be able to prepare a short list of stars, the declinations of which were so well fixed that the latitude of the boundary might be ascertained within the limit of errors of observation; but, before I had made much progress, it was clear that, as Mr. Conder would not be able to start for some weeks, but few of the stars which were being observed would be of any service, since they would be on the meridian too early in the evening; and, in fact, only one-third of the first programme was used. For this reason I determined to increase my list, by making use of the Washington

catalogue of 1860, together with the stars which had been observed at Sydney during the last three years in connection with the trigonometrical survey, and to make a complete catalogue of the stars which would be serviceable in New South Wales.

From these sources I have obtained 517, of magnitude not less than the seventh, which culminate within 30° of the zenith of any place lying between 29° and 37°S., *i.e.* with N.P.D. between 89° and 157°.

The method pursued in the formation of the catalogue was as follows:—I first selected 266 stars which are common to the Melbourne and Cape catalogues, intending to retain all, which, when brought up to 1880, agreed within 3″; but I afterwards raised the standard to 2″, and thus found that it was necessary to reject 26. In the same manner, 38 stars were retained out of 42 which were found in the Melbourne and Washington catalogues. The epoch of the latter being the same as that of the Cape catalogue, no preliminary calculation was necessary; and I kept no record of the number of stars rejected by inspection, but added 182 to my list.

Finally, from the 139 stars specially observed for the Surveyor General by Mr. Russell, it was increased by 42, which agreed in position with one other of the catalogues, and by 15 not found in any of them, but which, having been used for prime vertical observations, or for a zenith pair, of which the other component was well fixed, gave (from two or more results) the latitude within 1″ of the mean. Of the remaining 82 stars, a large number was already included in my catalogue; whilst, in accordance with the principle on which it is formed, I was obliged to exclude the others, although the deduced latitudes prove that the declinations must generally be very correct; whilst there is no certainty with respect to individual stars; since, in the case of zenith pairs, an error in the declination of one star may be completely or partially balanced by a corresponding error in that of the other.

As this catalogue is intended solely for latitude observations, where extreme accuracy in the time is not required, I brought the R.A. up to 1880 from any one of the others used in the compilation; therefore, for azimuth observations the Melbourne catalogue, or Mr. White's list of fifth-six circumpolar stars, must be used, and, for time stars, the Nautical Almanac. In finding the corrections for the epoch 1880, the first terms of the precession in R.A. and N.P.D. have been calculated in every instance; and the second term of each has been interpolated, and the mean of the proper motions adopted, for all stars which are common to the Melbourne and Cape catalogues. When either of these has been used with the Sydney observations, or with the Washington

catalogue, which does not give the second terms of the precession or the proper motions, these elements have been taken from the former.

Since the catalogue was commenced for a special purpose, it may not be uninteresting to give a short account of the results obtained by it, in conjunction with the stars observed at Sydney; premising that the conditions under which the observations at the boundary were made were far from satisfactory, as is shown by the following extracts from Mr. Conder's reports; to which I may add that the weather was generally unfavourable. At Sand Hill near Barringun, he says:—"The hill consists of a loose red sand in which it was impracticable to get anything like a stable foundation for the instrument, so that the level was constantly getting out of adjustment." Again, at Station 4, 20 miles east of the former, he remarks—"Many of these abnormal observations I believe to be occasioned by the loose sandy foundation on which the instrument stood, since the bubble of the level was sometimes moving whilst it was being read."

I have mentioned above that only one-third of the original programme of B.A.C. stars was used; and, of the extended list, so few had been observed when Mr. Conder started that, had he been compelled to depend on them, it would have been necessary to telegraph the declinations as they were observed, in order that he might be assured that the latitude of each station was known within very narrow limits before he left it. Fortunately the new catalogue met the difficulty; since he was able to select from it twenty-four zenith pairs culminating within about three hours, with this additional advantage, that twenty-two of these were obtained by three settings of the instrument; the corresponding groups consisting of four, five, and seven stars, which under ordinary circumstances would have given but eight pairs. This, however, was merely a chance coincidence of the zenith distances, the test of the accuracy of the stars' positions being of course the resulting latitudes.

These have an extreme range of 3″·49 in the 83 individual observations at Station No. 3, which remained after the anomalous results had been rejected, and of 2″·42 at Station No. 4, in the 26 means deduced from observations of the same pair; whilst the average differences of these means from the adopted latitudes of the four stations are respectively 0″·25, 0″·62, 0″·39 and 0″·44; those of Mr. Conder's best latitude stations, Mount Howard and Mount Lambie, with the advantage of perfect stability of the instrument and the power of selecting favourable nights for observation, being 0″·45 and 0″·52.

The results rejected from the appended observations are all thrown out by Pierce's criterion, the object of which is to do

away with any arbitrary selection. The principle on which this depends is, that whatever the number or the quality of a series of observations, there ought not to be any which differ from the mean by more than a definite quantity, which can be calculated by the method of least squares. An easy rule which I have discovered, and which is almost identical with the exact method, is this—when the number of observations is less than ten, any result may safely be rejected as abnormal which differs from the mean by more than three times the mean of the errors, irrespective of sign; and when the number exceeds ten, the corresponding limit is two and a-half times the mean error.

Of the twelve results thus rejected, the first at Barringun, and the pair C.C. 604, M.C. 781, at Sand Hill, consist of stars of which none enter into any other combination; so that it is impossible to say whether the positions of one or both in each pair are erroneous; but in the other ten cases, since the average range of error of Mr. Conder's observations of the same pair is much less than half a second, simple inspection proves that the latitude found from the pair M.C. 910 and C.C. 798 at each of the four stations, being much too great, the error can arise only from the declination of one or both being too high; and, as other combinations prove that the position of C.C. 798 is correct, it follows that M.C. 910 is wrong. Again, the latitude, as deduced from each of the three pairs of which B.A.C. 6,982 is a component being much below the mean at Stations 3 and 4, it is evident that the declination of that star is too low.

That discrepancies of this kind will be found, even in the best catalogues, is shown by the positions of two Nautical Almanac stars, viz., α^1 Crucis and ι Argûs. The seconds of declination of the former, in 1879, according to the Melbourne, Cape, and Williamstown catalogues, and the Nautical Almanac, are respectively—40″·91, 42″·96, 39″·80, and 37″·54; and those of ι Argûs, by the same catalogues—3″·72, 5″·81, 5″·39, and 1″·43. In the Nautical Almanac for 1880 both declinations have been altered; and deducing from these the positions in 1879, the seconds are—for α^1 Crucis, 40″·94; and for ι Argûs, 5″·06; whilst the corresponding values as observed at Sydney this year are 41″·20 and 3″·52, which differ from the Melbourne values by only 0″·29 and 0″·20.

I may add that, encouraged by the results obtained at the boundary, I have repeated the calculation of the latitudes of all the astronomical stations connected with the trigonometrical survey of the Colony, using the mean of the declinations derived from all available sources, and that in every case the probable error has been thus diminished.

LATITUDE—BARRINGUN.

Stars.				July 7.	July 10.	July 12.	July 13.	Mean.
				"	"	"	"	29° 0′ 40″
B.A.C.	4,332	B.A.C.	4,396	......	9·66	......	......	+ 9·66*
,,	4,430	,,	4,507	......	7·63	......	9·09	8·36
,,	4,608	,,	4,681	......	......	......	8·34	8·34
,,	4,868	,,	4,892	......	8·04	7·51	7·50	7·68
,,	5,127	,,	5,151	......	7·99	......	7·77	7·88
,,	5,227	,,	5,250	9·16	8·42	7·59	8·46	8·41
,,	5,272	,,	5,374	8·76	10·12*	9·16	7·84	8·59
M.C.	832	C.C.	694	......	10·60*	7·64	7·65	7·64
C.C.	729	,,	741 }	......	7·59	7·08	8·47	7·71
,,	,,	,,	773 }	......	8·61	7·76	8·43	8·27
,,	732	,,	741 }	......	8·14	7·24	8·06	7·81
,,	,,	,,	773 }	......	9·15	7·93	8·03	8·37
M.C.	904	M.C.	920	8·43	......	......	......	8·43
,,	910	C.C.	798	......	12·68	10·06	11·09	11·28*
,,	925	M.C.	920 }	......	8·06	7·72	8·47	8·08
,,	929	,,	,, }	......	7·79	7·96	8·44	8·06
,,	925	C.C.	859 }	......	8·35	7·63	8·62	8·20
,,	929	,,	,, }	......	8·10	7·86	8·60	8·19
,,	963	,,	968	......	8·52	7·61	8·98	8·37
								8·14

Latitude, 29° 0′ 48″·14.
Probable error, ± 0·048.
Results marked with an asterisk * are rejected by Pierce's criterion.
The pairs bracketed together were observed with one setting of the instrument.
The latitude is obtained by weighting the means according to the number of observations from which they were found.

Latitude—Sand Hill, near Barringun.

Stars.				July 28.	July 29.	July 30.	Mean.
				"	"	"	28° 59′ 10″
B.A.C.	4,608	B.A.C.	4,681	8·32	......	......	8·32
C.C.	566	M.C.	736	9·89	9·21	......	9·55
,,	,,	B.A.C.	4,892	9·24	9·13	10·62	9·66
,,	,,	M.C.	764	10·99	9·25	10·05	10·10
M.C.	736	B.A.C.	4,868	9·11	......	......	9·11
,,	,,	C.C.	601	9·66	......	......	9·66
B.A.C.	4,868	B.A.C.	4,892	8·45	......	10·50	9·48
,,	,,	M.C.	764	10·20	......	9·94	10·07
,,	4,892	C.C.	601	9·00	......	10·07	9·54
M.C.	764	,,	,,	10·74	......	9·50	10·12
C.C.	604	M.C.	781	7·18	6·42	8·00	7·20*
B.A.C.	5,127	B.A.C.	5,151	8·66	......	8·56	8·61
,,	5,227	,,	5,250	9·42	11·23	9·19	9·95
,	5,272	,,	5,374	8·60	......	9·58	9·09
,,	5,488	,,	5,519	9·69	9·31	9·77	9·59
,,	5,579	,,	5,639	8·73	9·08	8·62	8·81
,,	5,723	,,	5,782	......	9·77	9·96	9·86
C.C.	729	C.C.	741	9·89	9·94	......	9·92
,,	,,	,,	773	9·58	......	......	9·58
,,	732	,,	741	10·46	9·15	......	9·80
,,	,,	,,	773	10·14	......	......	10·14
,,	741	M.C.	878	10·85	10·25	......	10·55
M.C.	878	C.C.	773	10·53	......	......	10·53
,,	910	,,	798	11·99	12·12	......	12·06*
,,	920	M.C.	925	10·03	9·88	......	9·96
,,	,,	,,	929	9·11	9·76	......	9·44
,,	925	C.C.	859	9·60	10·21	......	9·90
,,	929	,,	,,	8·69	10·09	......	9·39
,,	963	M.C.	968	9·04	9·75	......	9·40
							9·64

Latitude, 28° 59′ 19″·64. P.E. ± 0″·068

Latitude—Station 3.

(About 10 miles west of Barringun.)

Stars.				Aug. 12.	Aug. 13.	Aug. 14.	Aug. 15.	Mean.
				"	"	"	"	29° 0′ 0″
B.A.C.	5,227	B.A.C.	5,250	...	9·00	8·92	..	8·96
,,	5,272	,,	5,374	...	9·49	7·24	10·06	8·93
,,	5,488	,,	5,519	...	10·03	8·15	8·45	8·88
,,	5,579	,,	5,639	...	8·53	8·49	8·19	8·40
,,	5,723	,,	5,782	...	9·17	8·99	8·60	8·92
C.C.	729	C.C.	741	...	9·30	8·97	8·87	9·05
,,	,,	,,	773	...	9·56	10·18	9·79	9·84
,,	,,	,,	798	...	10·66	9·80	9·73	10·06
,,	732	,,	741	...	8·49	8·67	8·90	8·69
,,	,,	,,	773	...	8·75	9·88	9·83	9·49
,,	,,	,,	798	...	9·30	8·96	9·22	9·16
M.C.	878	,,	741	...	8·43	9·24	9·35	9·01
,,	,,	,,	773	...	8·69	10·44	10·27	9·80
,,	,,	,,	798	...	9·24	9·52	9·68	9·48
,,	910	,,	,,	...	12·69	11·89	11·96	12·18*
,,	920	M.C.	925	9·40	8·56	9·04	7·50	8·62
,,	,,	,,	929	10·19	8·45	9·25	8·25	9·04
,,	925	C.C.	859	9·57	9·28	8·59	...	9·15
,,	929	,,	,,	10·36	9·16	8·80	...	9·44
,,	963	M.C.	968	10·22	9·65	8·36	9·50	9·43
C.C.	875	,,	997	...	10·99	9·78	8·78	9·85
,,	,,	,,	1,004	...	9·23	8·33	7·72	8·43
,,	,,	B.A.C.	6,877	...	10·53	10·22	9·73	10·16
M.C.	994	M.C.	997	9·93	10·38	10·28	9·16	9·94
,,	,,	,,	1,004	7·56	8·62	8·82	8·11	8·28
,,	,,	B.A.C.	6,877	8·96	9·91	10·70	10·11	9·92
,,	997	,,	6,982	8·17	8·90	7·18	6·74	7·75*
,,	1,004	,,	,,	5·80	7·13	5·72	5·68	6·08*
B.A.C.	6,877	,,	,,	7·18	8·43	7·61	7·68	7·72*
M.C.	1,038	M.C.	1,050	8·48	9·34	8·54	...	8·79
								9·19

Latitude, 29° 0′ 9″·19. P.E. ± 0·072.

LATITUDE—STATION 4.

(About 20 miles east of Barringun.)

Stars.				Aug. 19.	Aug. 20.	Aug. 21.	Mean.
				"	"	"	28° 59′ 50″
B.A.C.	5,227	B.A.C.	5,250	......	9·65	9·49	+9·57
,,	5,272	,,	5,374	......	......	8·30	8·30
,,	5,488	,,	5,519	......	8·16	9·14	8·65
,,	5,579	,,	5,639	......	......	8·51	8·51
,,	5,723	,,	5,782	......	......	9·20	9·20
C.C.	729	C.C.	741	......	......	7·74	7·74
,,	,,	,,	773	......	......	8·19	8·19
,,	,,	,,	798	......	......	8·40	8·40
,,	732	,,	741	......	......	7·89	7·89
,,	,,	,,	773	......	......	8·33	8·33
,,	,,	,,	798	......	......	8·55	8·55
M.C.	878	,,	741	......	9·64	8·94	9·29
,,	,,	,,	773	......	......	9·37	9·37
,,	,,	,,	798	......	......	9·59	9·59
,,	910	,,	,,	......	......	11·37	11·37*
,,	920	M.C.	925	9·46	......	9·00	9·23
,,	,,	,,	929	8·90	......	9·59	9·24
,,	925	C.C.	859	10·17	......	8·63	9·40
,,	929	,,	,,	9·62	......	9·23	9·42
,,	963	M.C.	968	8·59	......	8·51	8·55
C.C.	875	,,	997	10·66	......	8·80	9·73
,,	,,	,,	1,004	8·96	......	7·75	8·36
,,	,,	B.A.C.	6,877	10·70	......	9·61	10·16
M.C.	994	M.C.	997	10·59	......	8·69	9·64
,,	,,	,,	1,004	8·91	......	7·62	8·26
,,	,,	B.A.C.	6,877	10·63	......	9·49	10·06
,,	997	,,	6,982	9·59	......	6·96	8·28*
,,	1,004	,,	,,	7·92	......	5·91	6·92*
B.A.C.	6,877	,,	,,	9·63	......	7·77	8·70*
M.C.	1,038	M.C.	1,050	8·29	......	7·62	7·96
							8·96

Latitude, 28° 59′ 58″·96. P.E. ± 0″·092.

Notes on the occurrence of remarkable Boulders in the Hawkesbury Rocks.

By C. S. Wilkinson, L.S., F.G.S, Government Geologist.

[*Read before the Royal Society of N.S.W.*, 3 *December*, 1879.]

The sandstone formation upon which Sydney stands, and which is more than 1,000 feet in thickness, has been named by the late Rev. W. B. Clarke the *Hawkesbury Series*, on account of the rocks composing it being so largely developed within the area drained by the Hawkesbury River. The general character of the strata of this formation may be well seen, not only in the cliffs which form the shores of Port Jackson, but also in those bold escarpments which crest the sides of the valleys in the Blue Mountains.

These strata consist principally of thick-bedded yellow sandstones, with some pebble conglomerates and thin beds of argillaceous shale. The sandstones vary greatly in texture, from the fine-grained rock which is so extensively employed for building purposes in Sydney, to coarse grits passing into pebble conglomerates. The true bedding is more or less horizontal—near Sydney Heads it has a slight westerly dip, but the minor stratification often exhibits diagonal or false bedding; for instance, the laminæ of one bed may be dipping to the N.E. at an angle of 22 degrees, while the laminæ of the bed immediately above or below it are seen to be dipping in quite the opposite direction, thus showing changing movements of the currents by which the sand was drifted along. Therefore, the varying composition of the different laminæ and their frequent alteration in position from the horizontal to a high angle of dip, show how variable must have been the transporting power of the currents. In places these rocks are much discoloured by oxide of iron, and occasionally by black oxide of manganese. Fragments of wood and thin patches of coal occur in them. But it is more particularly to the shale-beds that I would now draw attention. These are very irregular, both in thickness and extent: they may be 15 or 20 feet thick in one place, and then, within the distance of a few yards, completely thin out. The fine sediment of which they were formed must evidently have settled down into irregular hollows in the floor of the sea, during intervals when the currents were not sufficiently strong to transport the coarser material which formed the sandstones and conglomerates.

The shales contain numerous small fragments of ferns, which are in a very remarkable state of preservation. I am collecting and figuring some of these, with the object of laying them before the Society on another occasion.

In the sections exposed in the quarries at Fort Macquarie, Woolloomooloo, Flagstaff Hill, and other places, may be seen angular boulders of the shale of all sizes up to 20 feet in diameter, embedded in the sandstone in a most confused manner, some of them standing on end as regards their stratification, and others inclined at all angles. They contain the same fossil plants that are found in the beds of shale from which they have evidently been derived. These angular boulders occur nearly always immediately above the shale-beds, and are mixed with very rounded pebbles of quartz; they are sometimes slightly curved, as though they had been bent whilst in a semi-plastic condition, and the shale-beds occasionally terminate abruptly, as though broken off. Had the boulders of soft shale been deposited in their present position by running water alone, their form would have been rounded instead of angular. It would appear that the shale-beds must have been partly disturbed by some such agency as that of moving ice, the displaced fragments of shale becoming commingled with the sand and rolled pebbles carried along by the currents. Occasionally in the beds above those which contain the angular boulders, occur a few rounded pebbles of shale, showing that the currents had swept along for some distance a few of the angular fragments until they had become rounded. These pebbles are usually oval in shape, and are embedded in such a manner that the longer axis of the pebble is nearly always inclined, or dips, towards the S.W., thus indicating that the transporting currents had chiefly come from that direction; whereas the angular boulders in the beds below are, as before mentioned, confusedly heaped together without regard to size.

These boulder accumulations occur in irregular patches apparently throughout the Hawkesbury Series. Besides in the places already mentioned, they may be well seen in the railway cuttings on the Blue Mountains, especially about Katoomba and Mount Victoria, where the shales contain splendid impressions of *Gleichenites* (*Thinnfeldia*, Morris) *odontopteroides*, M'Coy, specimens of which, obtained by Mr. A. H. McCulloch, M.P., have been described by Dr. Ottokar Feistmantel, Palæontologist to the Indian Geological Survey; and near the Lawson railway station Mr. Thomas Brown, J.P., of Eskbank, obtained a fine specimen of fossil fish, *Chleithrolepis granulatus*, Egerton. Another fish, *Myriolepis Clarkei*, Egerton, was found by the late Rev. W. B. Clarke.

From their lithological character, the Hawkesbury Rocks appear to have been formed in a comparatively shallow sea which was

subject to rapid and changing currents. This sea was bounded on the west by the mountains which extend in a northerly direction from the Shoalhaven River to the head of the Goulburn River : it is in the rocks near the ancient shore line that we should more especially expect to find ice-grooved pebbles, but none have yet been discovered. Its northern margin, owing to great denudation, cannot so readily be determined, but it probably did not extend north of the Hunter River ; and towards the east its extension is lost beneath the waters of the South Pacific ocean.

The Hawkesbury Rocks are intersected by numerous vertical joints, the principal of which strike about N. 15°—20° E., and S. 15°—20° W., with others at right angles, or nearly so, to them, thus dividing the rocks into cubical masses. Intrusive dykes of trap occur in several places, and near these the sandstone sometimes exhibits a well defined columnar structure.

I may here remark that the sandstones and conglomerates (*Gangamopteris beds*) of Bacchus Marsh, in Victoria, have been correlated by Dr. Feistmantel, with the Hawkesbury Series of New South Wales. Some years ago, I assisted the late Mr. Richard Daintree in making a geological survey of the district in which these conglomerates occur, and both Mr. Daintree and Mr. A. R. C. Selwyn, F.R.S., then Government Geologist, in their published reports, have expressed their belief that glacial transport had been concerned in the deposition of these rocks.

The Wentworth Hurricane.

By H. C. Russell, B.A., F.R.A.S., Government Astronomer.

[*Read before the Royal Society*, 3 *December*, 1879.]

When the gale known as the Wentworth hurricane was reported in the Sydney papers, I was much interested in its history, and collected all the information published, and on making further inquiry about it I was met by a spirit of hearty co-operation. From Captain Trouton, Captain Turpie (of the "John Williams"), Captain Mansell (of the "John Wesley"), Captain M'Leod (of the schooner "Superior"), and others, I obtained copies of a number of logs kept by vessels which had been in or near the storm; and these, together with the regular weather telegrams will, I hope, enable me to place before you a history of the storm, and to prove that, although in some of its details it looks like a rotary storm, yet it was not a cyclone, but one of the storms which are common when extensive tropical and polar currents meet.

But before taking the history of that part of the storm which has given it a name, I will ask you to consider some facts gleaned from the meteorological observers which are now scattered round most of the coast of Australia. The resident at the Lacipede Islands reports that on the 24th December a severe hurricane passed those islands. It was in fact the setting in of the N.W. monsoon, and the storm, obeying the general drift of the atmosphere, would move to the east; accordingly, on 27th December, Port Darwin reports strong N.W. winds, heavy rain, and low barometer. Between this point and the east coast of Queensland we have no reporting station; but the "General Pell" was near Cooktown, and she reports that on January 2nd the wind changed to N.W., with thick weather and abundance of rain. We then have another long gap to the "John Williams"; near the Island of Maré she got the change of wind to N.W. at 8 p.m. on January 9. Unfortunately the *hour* of the day when the changes took place is only mentioned by the "John Williams," and we cannot therefore be very exact in computing the rate of motion from the Lacipede Islands; but, taking the times as given, we find that the first section from the Lacipede Islands to Port Darwin shows that the storm was moving to the east at the rate of 8 miles per hour; the second to the "General Pell," 6 miles per hour; and the third to the "John Williams," 8 miles per hour; so that it seems highly probable this storm travelled from Lacipede

Islands to New Caledonia at the rate of about 8 miles per hour. It is much to be regretted that we have not more information about this change in the monsoon, but the facts, so far as they go, are in accordance with a well-known law of storms, viz., that when once they originate in a main current of air they persist for a long time, and are carried bodily along, as if floating in the atmosphere, rising or falling in intensity according to local circumstances.

This is constantly observed in America, and is of the greatest importance; because, knowing this fact and the ordinary rate of translation, the time when a storm will arrive at a point in its track can be stated with some degree of certainty; and, as you are aware, an effort is now being made to trace storms leaving America on the east coast, across the Atlantic to Europe; and I see no reason why the severe storms, sometimes called cyclones, which come with the setting in of the N.W. monsoon, should not be predicted in time to give shipping on the east coast of Queensland and thence to Fiji timely warning; but, unfortunately, we have very few meteorological stations on the north coast, and for a time the observations required must rest almost entirely with the shipping. However, if captains visiting these waters will take careful notes of any storms or changes they may meet—and the storm season is now coming on—I shall only be too glad to put the various logs together and endeavour to obtain the information that is wanted; and should it not be convenient to send me a copy of the log, I will copy if allowed to do so. The question involved is one of such great importance that I trust the members of the Royal Society will excuse my asking for ships' logs in a paper on storms.

Turning now to the facts collected about the Wentworth hurricane, it may be well to mention the sources from which they are derived.

(1.) The Sydney weather map.

(2.) The log of the "General Pell," passing from Somerset, December 31, to Brisbane, January 10. Published in the *Herald*.

(3.) The log of the schooner "Superior," passing through Capricorn Channel, January 6 to 10.

(4.) The log of the "Gunga," steamer, from Sydney to New Caledonia, where she arrived January 13.

(5.) The log of the "John Williams," off the coast of New Caledonia, January 5 to 12.

(6.) Observations at New Hebrides, published in the *Herald*.

(7.) Log of the "John Wesley," New Guinea to Fiji, December 26 to January 12.

(8.) The log of the "Wentworth," Fiji to Sydney, January 9 to 14, and a report from Norfolk Island.

(9.) Meteorological Observations in Queensland.
(10.) Log of the schooner "Pacific," San Christoval to Sydney, in *Herald.*
(11.) Log of "You Yangs," Rockhampton 8th, to Brisbane on 12th.
(12.) The "Victoria," Cooktown, January 4th, Brisbane 13th, in *Herald.*

In order to make the facts of the Wentworth hurricane as evident as possible, I have had a map prepared showing the tracks of the various vessels and their positions during the storm, together with arrows indicating the direction of the wind as observed in each case; upon the arrows cross-bars indicate the force of the wind on a scale, 0 calm and 10 a hurricane; and half-arrows have been put in to show the probable direction of the winds over a large area surrounding the storm. Near the position of the "Wentworth" on the 10th some curved arrows indicate the position of a small revolving storm, such as frequently arise in the plane of the meeting of two main currents; its motion governed by the prevailing equatorial current would be from west to east.

I have already stated that a great depression of the barometer took place at Port Darwin when the monsoon set in, and we learn from the log of the steamer "Victoria" that on January 5, when she was a day's steaming south of Cooktown, the barometer fell to 29·30. From observations made at Townsville by Mr. Charles S. Norris, and kindly sent to me, it appears the barometer reached its minimum, 29·594, at 3 p.m. on the 7th, and these proofs of a great barometric depression on the coast of Queensland are borne out by the weather telegrams. Such a depression in the tropics was quite sufficient to justify the expectation of the strong inrush of S.E. trades which is shown by the logs of the "General Pell" and "Superior," and by the weather telegrams, to have taken place on the 8th, 9th, and 10th January. As another, and the important factor in producing a great disturbance, we have the incoming N.W. monsoon, which had arrived at Cooktown on January 2 with very heavy rain, and which caught the "John Wesley" when to the north of the New Hebrides as a strong N.W. to N.N.W. gale on the 5th January, and it was evidently, therefore, exerting a general pressure upon the S.E. trade—in fact, forcing it bodily southwards. It is not surprising, then, that under the influence of a barometric depression on the coast of Queensland, and the pressure from the N.W. monsoon, the northern parts of the trade wind should rush in with the force of a gale. Here also is the explanation for its change in direction from S.E. to E. along the margin of the monsoon current.

In considering the effect of two great wind currents acting one against the other, it is necessary to bear in mind their great extent, and the fact that the pressure of the atmosphere above

them will to a greater or less extent prevent them from rising, except when a circular motion carries the air upwards in spite of all hindrances. As a familiar illustration of this condition, the meeting of two currents of water may be taken, for instance when a tributary river pours into the main stream its muddy waters, they push the waters of the main stream on one side into smaller compass, and therefore increased velocity, and generate in the plane of meeting small eddies, which in character are like those that we call circular storms when in the atmosphere.

At the meeting of the N.W. monsoon, which is loaded with moisture, and the cool S.E. trade, there is necessarily a formation of clouds and a great deposit of rain—facts which are repeatedly noticed in the logs which have been given me, and the observation of which indicate the position of the meeting-ground; whence it appears that its motion southwards was very gradual, for the "John Williams," near Maré, saw the threatening cloud bank to the N.E. of Maré on the morning of the 7th, at which time the E.S.E. gale was increasing every minute, and the barometer rising and falling as it would do under opposing forces. Yet the change to N.W. wind did not take place at Maré until the evening of the 9th.

Now it is worth while to stay a moment and inquire what the "John Williams," if clear of the reefs of New Caledonia, should have done, if acting under the belief that she was on the margin of a cyclone, the centre of which was then N.E. from her. Obviously to make a fair wind of the south-easter and steer N.W., there finding the wind gradually backing into S.S.W. and W. for fine weather, and thus allow the cyclone to pass south of her. But, according to the theory which I am advocating to-night, her proper course would have been to steer S.W., which would have given her a strong S.E. trade amounting to a gale of fair wind right on to or near the coast of Australia, which was not then affected by the S.E. trade south of Clarence River. Indeed it is more than probable that long before she reached the coast the wind would have changed into a north-easter.

But to return to the meeting-ground. The N.W. current was daily gaining power and becoming, if anything, more persistent in its southerly course, while the barometer depression on the coast of Queensland was disappearing, and with it one of the active causes of the S.E. gale. By evening of the 8th the E.S.E. gale at Maré was over, although the sea was still very confused. By noon of the 9th the "John Williams" was in a calm—a calm not in the middle of the storm, but between the two main currents, N.W. and S.E. But the schooner "Superior," in the same latitude as the "John Williams," was by no means in a calm; with her the 9th brought the most furious part of the S.E. gale, and she did not get fine weather until next day, and after having been driven nearly two degrees north. So that it is evident the N.W.

monsoon had gained more ground in the open ocean east of the New Hebrides than it had on the coast of Queensland. Speaking of the change of wind at Maré from E.S.E. to N.W., there is one important fact that I have not mentioned. At 8 p.m. on the 8th, when the gale was abating, the weather was marked by rain squalls—a sure sign of the meeting of the polar and equatorial currents; and the falling barometer was only another proof of the presence of the lighter equatorial current.

While these were the conditions with the "John Williams," the "John Wesley" had got the strong N.W. on the 5th, and carried a fresh N.W. gale all the way to Fiji, with fine weather; but, fine as it was, the bad weather was all the time at no great distance; for that afternoon, the 9th, when she was entering Kandavau Passage, the "Wentworth" cleared Kandavau at 4·30 p.m., and saw a suspicious-looking bank of clouds in the south-west, and the lightning which was seen flashing through it told its character as plainly as words could have done. At that time the "Wentworth" was in a strong N.N.W. gale, and kept on her course to Sydney, which lay right through the cloud-bank. Now from what has been said about the relative positions at this time of the two main currents, N.W. and S.E. (see map), it is obvious that the storm into which the "Wentworth" was steaming was a storm set up in the meeting-line of these currents, and it was probably intensified by the extra force of the N.W. wind coming down over the open sea west of Fiji.

Now the motion of this storm, which was visible from the "Wentworth," would be, as before stated, to the east; in fact, away from the "Wentworth's" track, but she by steaming ahead got into the storm before it had time, with its slow progress of 8 miles per hour, to pass away. It is evident that she ran into the north-west side of it, and found the wind veering to westward and the sea very high and confused. Having a fair wind, she probably made 10 miles per hour, and from 8 p.m. to 3·30 p.m., when she was obliged to heave to, that would make her progress 55 miles into the storm—a position which was near its centre, judging from the furious storm she met. Now she was hove-to for thirteen hours, and her position by log shows that she drifted to eastward at the rate of 3 miles per hour, while we know that the storm was travelling 8 miles per hour, and therefore passing the steamer at the rate of 5 miles per hour, *i.e.*, 100 miles in the thirteen hours; this may, it seems probable, be taken as something like the radius of the storm, and would make its diameter 200 miles, and this accords with that of some similar storms which have passed over Sydney.

That the "Wentworth" was on the N.W., and not on the south side of the storm, seems to me to admit of no doubt; and if at 4 p.m. she had changed her course to west she would have avoided the worst of it.

The "Wentworth's" experience makes the storm look exactly like a small cyclone; but it must be borne in mind that the changes of wind are the same which occur here constantly without any cyclone, and it is quite possible to explain the "Wentworth" storm without recourse to the cyclone theory.

It is interesting also to observe that this was not the only case of the same phenomena, for the "John Williams," on the 12th, met a storm of exactly the same sort; and it fortunately so happens that the "Gunga," "John Williams," and "Wentworth," were all in the same latitude at noon on that day; the "Gunga" 300 miles west, and the "Wentworth" 180 miles to the east, both in fine weather, and they saw nothing of the furious gale in which the "John Williams" had to heave-to, thus proving its circumscribed character. All the evening of the 11th she had very strong northerly winds, which increased at night, and by 2 a.m. on the 12th became a strong gale from N.N.W., and such a dangerously high sea from S.W. that she was obliged to heave-to. At noon on 12th, the wind was W.N.W., and sea very heavy from S.W.; at 6 p.m., wind W.S.W., and sea moderating; barometer at 2 p.m. had been down to 29·40, and gradually rose in the afternoon.

It is worth remark that the "Wentworth" was hove-to from 3·30 a.m. till 4 p.m., or thirteen hours, and the "John Williams" from 2 a.m. to afternoon the same day, or about fourteen hours.

You will have noticed that the hurricane of the "Wentworth" was on the 10th, and that of the "John Williams" on the 12th, the latter being S.W. from the former; and, therefore, it may seem to the advocates of the cyclone theory that it was the same storm which had travelled in the track laid down for such storms. A moment's consideration will, however, suffice to show that if such had been the case, the "Wentworth," travelling in the same direction as the supposed track of the storm, and parallel to it, must have had the wind from N. to N.E. all the way, and the storm should have left her on the 10th, with wind at N.W., while the fact is it did leave her with wind at S.S.W., and she had winds from S.S.W., W.N.W., and W. Again, if it were the same cyclone it would be difficult to account for its being with the "John Williams," and on Norfolk Island, 250 miles away, on the same day.

We have therefore two distinct cyclones on the small scale, at no very great distance, and separated by only two days, in time to account for. Fitzroy long since proved that in the meeting of extensive main currents, such as those we have been considering, there is always a small cyclone development,—or condition in which a trifling obstacle, such as a hill or an island, may start a cyclone; and other writers, especially in America, have proved the same condition to be a fact; and from the remarks made

to-night it would appear that at the change of the monsoon in the north we have a similar result. The question is a most important one, because the course to be taken on meeting such storms may be different from that advised under the cyclone theory, since the former supposes the storm to be moving to the east, and the cyclone theory supposes the storm to be moving to W.S.W., except in rare cases, when it recurves to S.E.

I have watched many such small spiral storms pass over this Colony; and they all without exception move to the east, with the wind veering as in the "Wentworth" hurricane. I am therefore inclined to think that the same rule will hold good in the tropics for the so-called cyclones which come with the change of monsoon, and which I believe to be only intensified storms of the spiral form moving to the eastward.

APPENDIX.

Epitome of various Logs, for each day:—

January 8th, the "General Pell," on coast of Queensland, had a strong S.E. gale with terrific squalls.

The "John Williams," near the island of Maré, all day a whole gale from E.S.E. Barometer, 29·70, fallen a tenth since yesterday. Sea very high from S.E.

"John Wesley," 200 miles N.E. of Sandwich Island. Strong N.N.W. wind all day.

"Superior," in Capricorn Channel, a gradually increasing gale from east all day, with heavy rain; weather foggy.

We have here evidence that a strong E. to S.E. gale was blowing on January 8th from New Caledonia right on to the coast of Queensland, at the same time that a strong N.W. to N.N.W. gale was blowing, and had been blowing for some days, on the "John Wesley," then sailing to N.E. of the New Hebrides. On the coast of Queensland the barometers were low, and the gale steadily increasing from S.E., with high sea setting on the coast.

January 9th, similar weather prevailed on the coast of Queensland. The "Superior" says that at 10 a.m. it was blowing a whole gale from the east, with a high and confused sea from east and north, showing that here the seas from the S.E. and N.N.W. gales were mixing; at 5·30 p.m. that evening it was blowing a perfect hurricane where the "Superior" was, wind veering to southward.

The "John Williams" reports the gale decreasing at E. by S., barometer, 29·80; by noon it was calm and cloudy, and a high and confused sea; by 8 p.m. the wind came light from N.W., with continuous rain; barometer, 29·85.

At Sandwich Island, on the 9th, it blew a fearful hurricane for four hours from the east; then a lull of a few minutes, and then it blew with almost equal violence from south. Nothing is said about the weather before or after.

The "Wentworth" left Levuka at 6 a.m. on the morning of the 9th; the wind had been northerly for some days. All day it was fine and very hot, a thick bank of clouds was seen forming in S.W. towards evening; at 4·30 p.m. cleared Cape Washerton, and when 40 miles south-west of that point the wind shifted into N.N.W., and the barometer began to fall with startling rapidity; at the same time a wall-like sea was observed making up from N.W., and in S.W. lightning without thunder was observed in the bank of clouds; wind then increased with hurricane, squalls, and rising sea; at 3·30 a.m. that night (that is a.m. of the 10th January), barometer was down to 29·45; the "Wentworth" was hove-to, and the wind and sea continued furious and did much damage to the ship.

"John Wesley," latitude 18·12, longitude 176·40 east at daylight. Brisk breeze again from N.N.W. and continues all day, barometer, 30·05 and rising.

January 10th, "General Pell," heavy south-east gale north of Cape Moreton.

"Pacific" left San Christoval January 10th, and had fine weather all the way to Sydney.

"Superior," 4 a.m. on the 10th, much less wind and sea; at noon, moderate breeze from S.S.W. to S., cloudy, light southerly weather and fine day.

"Gunga," at noon of 10th, latitude 30·2, longitude 157·24, wind N.E. with heavy cross sea, E. at 4 a.m., E.S.E. at noon, p.m. S.E.; fresh breeze and fine clear weather throughout.

"John Williams," 10th January, 6 a.m.: Wind, N.W., cloudy, sea rising from all points, barometer falling, wind veering northerly; noon, latitude 22·40, longitude, 168·20; wind N.E., a fresh breeze and cloudy sky, barometer 29·70; 4 p.m., wind N.N.W., frequent severe squalls and remarkably heavy rain, high confused sea, barometer 29·65; midnight, wind round to W., sea very confused, sky very threatening to westward, barometer 29·63.

"John Wesley" beating up Kandavau passage with brisk N.N.W. and squally unsettled weather.

"Wentworth," January 10th, 3·30 a.m.: Furious gale from N.N.W., high sea, ship hove-to; daylight, blowing sails from gaskets, confused sea, wind N.; at noon, latitude 20·26, longitude 176·50, wind N.W., very high sea; 4 p.m., wind west, gale moderating a little; midnight, wind S.S.W., light; daylight, N.N.W. to N.; noon, N.W.; 4 p.m., W. It thus appears that from 8·30 p.m. of 9th the gale blew furiously until 4 p.m. of the 10th, between N. and W., and that after passing the west point there was little or no force in the wind.

January 11th, strong southerly winds and rain on the coast of Queensland.

The "Superior" had moderate southerly winds and fine weather.

The "Gunga" at 6 a.m. had very heavy squalls from S.E., and heavy cross sea; at noon, latitude 27·25, longitude 160·38, strong S.E. gale, terrific sea; 4 p.m., strong S.E. gale, terrific sea; midnight, gale abating.

"John Williams," 6 a.m., wind W.N.W., fresh gale, very high sea from south, barometer 29·53; noon, latitude 24·22, longitude 168·30 east, wind N.W., barometer 29·59; 4 p.m., fresh gale from N.W., sky clearing to west, barometer 29·55; midnight, gale increasing N.W., barometer 29·52; at 2 a.m. N.N.W. gale, with dangerous high sea, barometer 29·40, obliged to heave the ship to.

"John Wesley," 6 a.m., squally, bad weather, wind N.N.W., similar weather all day, squally with rain at night.

"Wentworth," 6 a.m., thick threatening weather; noon, continued heavy sea, roll of sea apparently against the current; p.m., less sea, sunset fine; noon, latitude 22·35, longitude 174·37.

January 12th, strong southerly wind and rain on the coast of Queensland.

"Superior," light southerly winds, fine.

"Gunga," 6 a.m., wind E.S.E., heavy cross sea; forenoon, S.W. gale with rain lasted some hours; afternoon, wind and sea going down; fine at midnight. Position at noon, 24·57 latitude, 163·30 longitude.

"John Williams," January 12th, strong gale from N.N.W. with dangerously high sea from S.W., barometer 29·40, hove ship to; 8 a.m., wind N.W., hard squalls, barometer 29·55; noon, very heavy sea from S.W., wind W.N.W., latitude 25·15, longitude 168·50; 6 p.m., wind W.S.W., moderating, sea falling, barometer 29·60; 10 p.m., wind W.S.W., moderate gale, barometer 29·70; midnight, fresh breeze W.S.W., sea settling down fast.

"John Wesley," strong breezes, squally, wind N.N.W.; at 8 p.m., heavy squall of wind and rain.

"Wentworth," on 12th, at noon, latitude 25·20, longitude 171·40, light airs and showers; W.N.W., N.E., S.W., &c., middle and latter parts very fine.

Discussion.

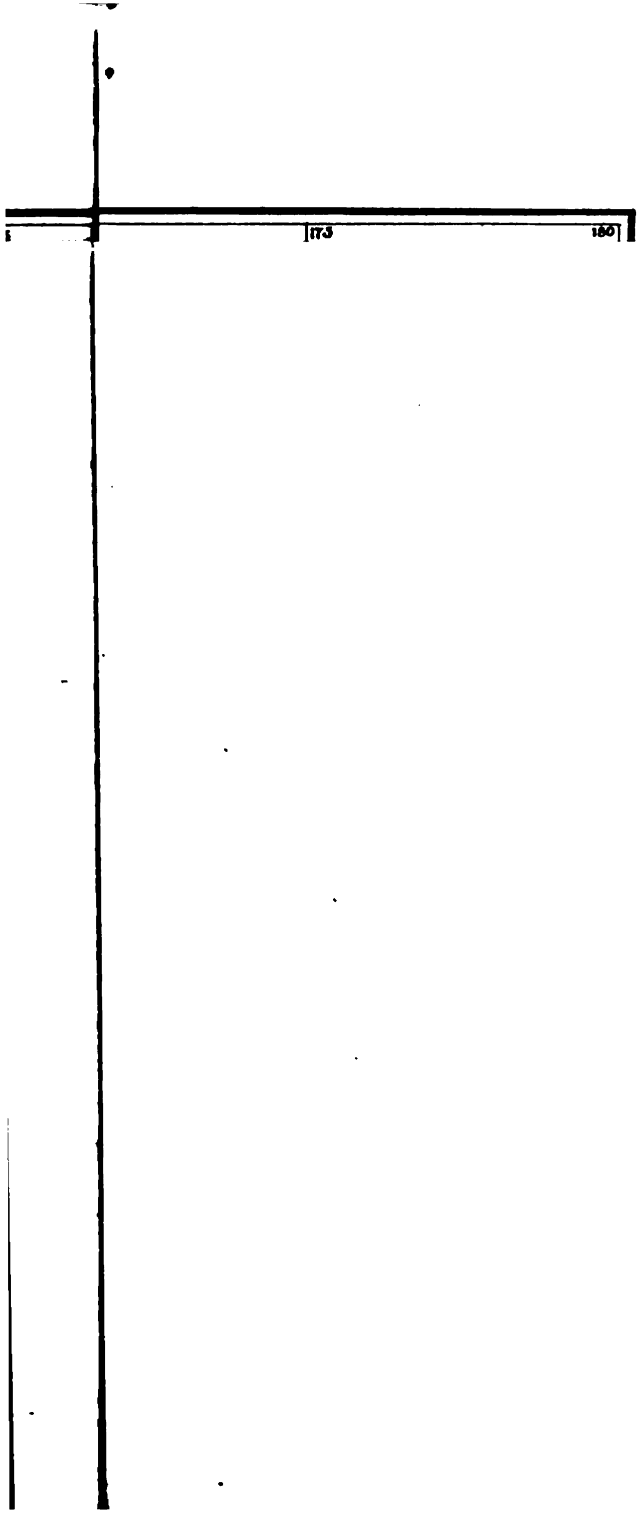
Mr. P. G. King asked Mr. Russell if the cyclones of the southern hemisphere always revolved in the same direction.

Mr. Russell said theoretically they were obliged to do that, but he did not think they had sufficient proof to say practically whether that was the fact. If they considered the direction in which the currents meet, it was evident that the resulting rotation must be in accordance with theory. It was a difficult matter to study all the effects of such a storm as he had described, and the conditions under which it existed; they could only get points of observation here and there, and too much was left to the imagination. If one could find a theory for these storms it would be satisfactory, for it was very much to be desired that the actual conditions under which they arose should be known. The steamer "Wentworth" misapprehended the condition of affairs, the Captain thinking he was on the south side of the storm when

he was on the north side, and that it was going to pass hi on that side. The wind coming from the north to the nor west worked around by west, and then came in by south-we The vessels "John Wesley" and "John Williams" experienc exactly the same change of wind as the "Wentworth," they also were at the meeting ground of the two currents, t stronger of which carried the other away with it. In the ex rience of all these vessels the strongest winds were betwe north and west. On the other hand, sometimes the strong part of the wind came from the south-west and they lost sight the north-westerly current. The "Dandenong" storm was o of a similar character. In that storm they had a north-wester current blowing over the coast of Australia, backing to west, a then round to south-west. He had traced the polar current that storm from Portland to the latitude of Brisbane. H particular object in writing this paper was to induce captai trading to these northern ports to furnish accurate informati with regard to the storms when they occurred. He was su that a great deal of property might be saved if these gales we properly understood.

Mr. KING thought the Society should convey all thanks to M Russell for his valuable paper, which was one that ought to le to great results in the maritime interests of this part of t world. It was a subject in which science brought its aid for t preservation of life and property, and for the comfort of perso travelling at sea. Mr. Russell was evidently on the right tra to find out the conditions and directions of these storms and lay down a reasonable rule by which they could be to so extent avoided, and he only hoped that he would see his w clear to study the important subject more thoroughly, a eventually work out a theory which could be relied upon.

[Map.]


173
180

PROCEEDINGS.

PROCEEDINGS

OF THE

ROYAL SOCIETY OF NEW SOUTH WALES.

WEDNESDAY, 28 MAY, 1879.

ANNUAL GENERAL MEETING.

Hon. Professor SMITH, C.M.G., V.P., in the Chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society:—

Gabriel, C. Louis, St. John's College, University.
Hills, Robert, Elizabeth Bay.
Jarvie, Rev. A. Milne, Marrickville.
Kemmis, Rev. Thomas, St. Mark's Parsonage, Darling Point.
Meslée E. Marin de la, Arnott House, Wynyard Square.
Matthews, Robert, Tumut-street, Adelong.
Mearns, R. Livingstone, D.D.S., Philadelphia, 36, Wynyard Square.

The certificates of eleven new candidates were read.

Two hundred and fifty-three donations were laid upon the table.

The Annual Report of the Council was then read.

"The Council bring before the members of the Royal Society of New South Wales their Report for the year ended 30th April last, and in doing so are glad to be able to point to the steady progress the Society has enjoyed during the past year. The past session began on May 1st, 1878, with 347 members on the roll, besides fourteen honorary members. 78 members were elected during the past year, in addition to one honorary member, whilst the Society lost six members by death and fifteen by resignation, thus beginning the session of 1879-80 with 404 members, in addition to fifteen honorary members. The most serious loss the Society has sustained during last year by death is that of our former venerable Vice-President, the Rev. W. B. Clarke, M.A., F.R.S., &c., a loss which will long be felt, Mr. Clarke having been both a most zealous contributing member and a most active member of the Council. At a meeting held at the Society's rooms on 3rd July, 1878, it was proposed and carried, 'that a Clarke Memorial Fund should

be raised, and the proceeds be devoted to the establishment of free lectures on geology, and a periodical distribution of a prize medal for distinction in geology and mineralogy.' A Committee was formed, and all the necessary business transacted in order to secure the realization of this worthy object. The result, in a pecuniary point of view, has hitherto not been such as the case deserved. Many cases quite outside the object in view interfered with a successful result for the present. There is up to date about £334 in the hands of the Honorary Treasurer of the Clarke Memorial Fund, £275 of which is placed on fixed deposit at the Bank (at 6½ per cent. interest), until a renewed effort will enable the Committee to carry out the object of the memorial. The Society held during last session eight monthly meetings, at which thirteen papers were read, some of very considerable and general interest. In addition there were seven Sections holding monthly meetings, which, judging from the larger attendance of members, appear to become more appreciated year by year, and cannot fail to make this Society more and more useful and popular. The annual conversazione was held on the 15th May last, and proved a great success both as regards interesting exhibits and a most numerous attendance. Indeed, it will be a matter of serious consideration for your Council to fix upon a larger and more suitable place for these conversaziones, which, as the Society increases, require more space than hitherto. The finances of the Society are in a satisfactory condition, as shown by the balance sheet of the Hon. Treasurer, submitted this evening. In addition to the ordinary income from subscriptions of members, a contribution of £250 granted by Parliament during last session under the condition of £500 being obtained privately, was duly received from the Government, thus materially assisting the Council in enlarging the sphere of usefulness of this Society. The acquisition by purchase of the building occupied by this Society has proved a great boon, and enabled the Council to establish a library-room, open to members on Mondays, Wednesdays, and Fridays, from 7 to 10 p.m.; and on Wednesdays also from 4 to 6 p.m., during the session; and during the recess—January to May—on Wednesdays, from 4 to 6 and 7 to 10 p.m. Though not very large, it is already fairly stocked with most useful and valuable books, obtained partly by purchase and partly by very numerous donations from learned Societies in the Colonies and abroad. The Society subscribed during the past year to forty periodicals, English, French, and German, which were received as usual by the monthly mails. In addition, forty-two scientific books were purchased. Advantage had been taken of the presence of Professor Liversidge in Europe, who undertook the purchase for the Society of several most useful scientific works, and also of a very excellent microscope. 767 publications were, since last May, received by the Society as donations, while the number of

publications forwarded by this Society during the past year to scientific institutions, editors, libraries, &c., in Great Britain, the Colonies, America, and the Continent, amounted to 877, presented to 250 Societies, &c. The preliminary meetings of the Sections for the election of their Chairman and Committees, and the fixing of the days of their meetings during the current session, have taken place in April, which enables the Sections to begin their regular work this month. The Council expresses the hope that the new session now opened will be a fruitful one, and that many active members will be added to the hitherto small list of contributors of papers at our monthly and sectional meetings."

The following Financial Statement for the year ending 30th April, 1879, was presented by H. C. Russell, Esq., B.A., F.R.A.S., Honorary Treasurer.

GENERAL ACCOUNT.

RECEIPTS.

	£	s.	d.	£	s.	d.
To Balance in Union Bank, 30th April, 1878				63	14	1
,, Subscriptions and entrance fees	516	2	0			
,, Sale of books	1	5	6			
,, Government Grant	250	0	0			
				767	7	6
				£831	1	7

EXPENDITURE.

	£	s.	d.	£	s.	d.
By Hire Masonic Hall, for Conversazione	5	0	0			
,, Refreshments—Conversazione	27	10	9			
,, Sundry Expenses—Conversazione..............	22	0	0			
,, Furniture and Effects	74	5	2			
,, Books	152	19	0			
,, Printing	24	3	0			
,, Engravings	10	0	0			
,, Stationery	3	8	6			
,, Bookbinding	17	12	6			
,, Advertisements	20	4	8			
,, Reporter (discussions on papers)	3	3	0			
,, Bank Commission on Drafts	2	16	0			
,, Commission (collecting subscriptions)	1	7	3			
,, Delivering Society's Journal to Members ...	2	18	6			
,, Petty cash, postage, freight, packing, &c. ...	74	11	4			
,, Insurance on books, furniture, &c.	1	5	0			
,, Gas account	28	10	9			
,, Assistant Secretary's salary, to 30th April, 1879 (twelve months)	84	0	0			
,, Mrs. Casey—Cleaning rooms, to 30th April, 1879	12	0	0			
,, Mrs. Casey—Refreshments at Monthly Meetings	13	8	6			
				581	3	11

EXPENDITURE—*continued.*

	£	s.	d.	£	s.	d.
By Entrance fees transferred to Building Account	81	18	0			
,, Amount transferred to Building Account ...	108	13	6			
				190	11	6
,, Exchange on country cheques				1	6	0
,, Balance in Union Bank, 30th April, 1879 ...				58	0	2
				£831	1	7

NOTE.—£70 from 1878 yet to be accounted for.
Receipt for £89 9s. 11d. remitted to Trübner & Co., for books, to be produced.

Audited,
R. A. A. MOREHEAD.
HARRIE WOOD.

H. C. RUSSELL, Honorary Treasurer.
W. H. WEBB, Assistant Secretary.

30th April, 1879.

BUILDING FUND ACCOUNT.

RECEIPTS.

	£	s.	d.	£	s.	d.
To Subscriptions	1,064	14	0			
,, Government Grant	500	0	0			
,, Rent of hall to Academy of Art	200	0	0			
,, Hire of room to Sundry Societies	29	13	0			
				1,794	7	0
,, New Members' entrance fees—transferred from General Account	81	18	0			
,, Amount transferred from General Account...	108	13	6			
				190	11	6
				£1,984	18	6

EXPENDITURE.

	£	s.	d.	£	s.	d.
By Cash paid towards purchase of building......	1,525	0	0			
,, Law costs of mortgage	15	0	0			
,, Law costs of title..................................	56	1	0			
,, Interest paid in lieu of rent prior to completion of purchase	53	17	9			
,, Sundry improvements and repairs	34	5	0			
,, City rates	8	2	0			
,, Interest on £2,000 @ 6 %, to 31st March, 1879	81	0	9			
,, Interest on overdraft	1	2	6			
,, Insurance on building	5	0	0			
,, Amount at fixed deposit, February 2nd, 1879	100	0	0			
,, Amount at fixed deposit April 30th, 1879...	100	0	0			
				1,979	9	0
,, Balance in Union Bank, 30th April, 1879 ...				5	9	6
				£1,984	18	6

Audited,
R. A. A. MOREHEAD.
HARRIE WOOD.

H. C. RUSSELL, Honorary Treasurer.
W. H. WEBB, Assistant Secretary.

30th April, 1879.

STATEMENT OF ASSETS AND LIABILITIES FOR THE YEAR ENDING 30TH APRIL, 1879.

Assets.	£	s.	d.
To Balance in Union Bank to credit of General Account......	58	0	2
,, Subscriptions and entrance fees due	13	13	0
,, Furniture, painting, books, &c.—value unknown—taken as insured	1,000	0	0
,, Rent of room to Sr. Simonetti	6	10	0
,, Premises in Elizabeth-street (cost of purchase)	3,525	0	0
,, Balance in Union Bank to credit of Building Fund Account	5	9	6
,, Amount of fixed deposits to credit of Building Fund Account	200	0	0
	£4,808	12	8

Liabilities.	£	s.	d.
By Trübner & Co.—Periodicals	11	13	4
,, Savings Bank—Loan on Mortgage	2,000	0	0
,, Balance of assets over liabilities	2,796	19	4
	£4,808	12	8

Examined,
R. A. A. MOREHEAD.
HARRIE WOOD.

H. C. RUSSELL, Honorary Treasurer.
W. H. WEBB, Assistant Secretary.

30th April, 1879.

The statement was adopted.

Mr. W. G. Murray and Mr. James Manning were elected Scrutineers for the election of officers and members of Council for the current year.

A ballot was then taken, and the following gentlemen were duly elected officers and members of Council for the current year:—

PRESIDENT
(ex-officio):
HIS EXCELLENCY SIR HERCULES ROBINSON, G.C.M.G., &c., &c., &c.

VICE-PRESIDENTS:
HON. J. SMITH, C.M.G., M.D., &c., &c.
CHARLES MOORE, F.L.S.

HONORARY TREASURER:
H. C. RUSSELL, B.A., F.R.A.S., &c.

HONORARY SECRETARIES:
PROFESSOR LIVERSIDGE, F.C.S., F.G.S., &c., &c.
DR. ADOLPH LEIBIUS.

COUNCIL:

CRACKNELL, E. C.
DIXON, W. A., F.C.S., F.I.C.
HIRST G. D.
MONTEFIORE, E. L.
ROLLESTON, CHRISTOPHER, C.M.G.
WRIGHT, H. G. A., M.R.C.S.

Mr. W. MacDonnell gave notice that he intended to propose at the next general meeting the following addition to By-law 4, after the sentence ending "ordinary members of Council," to insert the following:—

"Such list to be printed and distributed amongst the members weeks previous to the date fixed for the Annual General Meeting. It shall be in the power of members to propose the name or names of other members who may be considered eligible for election to the Council, such propositions to be in writing, signed by the proposers and seconders, and to be forwarded to the Society weeks before the Annual Meeting. The names of these candidates, together with the names of their proposers and seconders, to be appended to the printed list issued by the Council."

It was announced that arrangements had been made for the various Sections to hold meetings during the ensuing year, on the following dates:—

Sections.

At 8 o'clock p.m., except Section D, which meets at 4 p.m.

	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
A—Astronomy, &c., Friday..............	2	6	4	1	5	3	7
BC—Chemistry & Geology, Wednesday	14	11	9	13	10	8	12
D—Natural Hist. & Botany, Monday (4 p.m.)................................	5	2	7	4	1	6	3
E—Microscopy, Monday	12	9	14	11	8	13	10
G—Literature & Fine Arts, Friday......	30	27	25	29	26	31	28
H—Medical, Friday	9	13	11	8	12	10	14

The names of the Committee-men of the different Sections of the Society were also announced, viz.:—

Astronomy.—Chairman: H. C. Russell, B.A., F.R.A.S. Secretary: G. D. Hirst. Committee: H. G. A. Wright, M.R.C.S., W. J. MacDonnell, F.R.A.S., Rev. G. Martin; J. Brooks, F.R.G.S.

Chemistry and Geology.—Chairman: W. A. Dixon, F.C.S., F.I.C.; Secretary: J. Warner McCutcheon. Committee: R. Hunt, F.G.S., C. S. Wilkinson, F.G.S., Harrie Wood, and S. L. Bensusan.

Natural History and Botany.—Chairman: R. D. Fitzgerald, F.L.S. Secretary: A. J. Stopps, Keeper of Herbarium, W. D. Armstrong. Committee: Messrs. Daintrey and James Norton.

Microscopy.—Chairman: Rev. George Martin. Secretary: P. Pedley. Committee: G. D. Hirst, W. MacDonnell, W. Morris, L.F.P., and S. Glas., H. G. A. Wright, M.R.C.S.

Literature and Fine Arts.—Chairman: E. L. Montefiore. Secretary: Percy E. Williams. Committee: E. Du Faur, Ludovico Hart, A. W. Jackson, G. A. Morrell, C.E.

Medical—Chairman: Dr. James Cox. Secretaries: Drs. Sydney Jones and McLaurin. Committee: A. Roberts, M.R.C.S., H. G. A. Wright, M.R.C.S., Drs. Fortescue, M.B. & F.R.C.S., and M. S. Clune, M.A., Lic. K. & Q. Coll. Phy.

The Hon. J. Smith, C.M.G., Vice-President, then read his address.

WEDNESDAY, 4 JUNE, 1879.

ORDINARY MONTHLY MEETING.

Hon. J. Smith, C.M.G., V.P., in the Chair.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society, viz.:—

Arnheim, E. H., junr., Royal Mint, Sydney.
Bond, Albert, Bell's Chambers, Pitt-street.
Dowling, Neville, Wallace-street, Woollahra.
Foreman, Joseph, M.R.C.S., L.R.C.P., Edin., Lithgow.
Gerard Francis, Occupation of Lands Office.
Jefferis, Rev. James, LL.B., The Retreat, Newtown.
Newman, W., care of Messrs. David Jones & Co., George-street.
Shepard, A. D., Adelong.
Stephen, Alfred F. H., 3 Cambridge Terrace.
Trebeck, P. C., George and Market Streets.
Walker, H. O., Australian General Assurance Co., 129, Pitt-street.

The certificates of five new candidates were read.

Eighteen donations were laid upon the table.

Mr. W. MacDonnell moved,—That the addition be made to By-law IV of which he had given notice at the last meeting.

The Chairman suggested that some member might move the postponement of the debate upon this resolution until the next General Meeting, in order to allow the Council time to consider it.

It was accordingly agreed to postpone the discussion until the next monthly meeting.

Mr. H. C. Russell gave notice that he should at the next meeting move the following alterations and additions to Rules 2, 3, and 6 respectively:—

"That in Rule 2 the words "shall be *ex officio* the President of the Society," be struck out, and the following words put in their place, viz.: 'is *ex officio* the Honorary President of the Society.'

"That in Rule 3, after the words 'shall consist of' the following words, be inserted, viz.: 'a President and'

"That in Rule 6 the words 'one guinea' be struck out and the following words inserted, viz.: 'two guineas'; also that the words 'ten pounds' be struck out, and the words "twenty guineas" inserted.

"And that the question of raising the annual subscription be also considered."

Professor LIVERSIDGE also gave notice that he should at the next meeting propose a Bye-law providing for the election by the Council of Corresponding Members; also a Bye-law limiting the age of members to twenty-one years at least.

Mr H. C. RUSSELL then read a paper on "The Gem Cluster in Argo."

Professor LIVERSIDGE then read a paper on "The International Geological Congress at Paris."

WEDNESDAY, 2 JULY, 1879.

ORDINARY MONTHLY MEETING.

The HON. J. SMITH, C.M.G., V.P., in the Chair

There were about fifty members present.

The Minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society:—

Rev. J. J. Garvey, Woollahra.
Frederick H. Moore, Exchange Buildings.
Dugald Thomson, 20, Charlotte Place, Sydney.
F. A. A. Wilson, Alfred-street, St. Leonards.
John Young, Town Hall, George-street.

The certificates of eight new candidates were read.

Professor LIVERSIDGE announced that there was a small balance in the hands of the Hon. Treasurer available for the purchase of books for the library, and suggested that the Committees of the various Sections should prepare lists of the books they required, as a guide for the expenditure of the money.

On behalf and in the name of the Council, Mr. C. MOORE proposed Mr. George Bentham, F.R.S., C.M.G., as an honorary member of the Society; also that letters of congratulation be sent by the Society to Mr. Bentham and Baron von Müeller, F.R.S., K.C.M.G., congratulating them on the completion of their great work "Flora Australiensis."

The resolutions were duly carried.

Sixty-seven donations were laid upon the table.

Professor LIVERSIDGE read a letter received from Mr. Frank Crisp, LL.B., F.L.S., Secretary of the Royal Microscopical Society

of London, stating that their Society had recently determined to elect the Presidents of kindred Societies *ex officio* Fellows of the Society, which distinction, in regard to the Royal Society of New South Wales, would fall upon the Chairman for the time being of the Microscopical Section.

Mr. A. S. WEBSTER, Hon. Treasurer of the Clarke Memorial Fund, stated that 133 subscriptions had been received, amounting to £360 10s. 6d., and that the expenditure for advertising in this and the neighbouring Colonies, Secretary's remuneration, &c., was £82 13s. 4d., leaving a balance of £277 17s. 2d., out of which the sum of £275 had been placed in the Oriental Bank as a fixed deposit, at 6 per cent.

The consideration of the disposal of this fund was postponed.

Mr. W. MacDonnell's motion to amend Bye-law 4 was then discussed.

Amendments to the motion were read by the Chairman, Professor Liversidge, and Mr. J. Kinloch, the consideration of which, together with that of the Bye-laws generally, was referred to a Committee composed of the Council, together with Messrs. W. McDonnell, J. Kinlock, and A. S. Webster.

WEDNESDAY, 6 AUGUST, 1879.

ORDINARY MONTHLY MEETING.

Hon. J. SMITH, C.M.G., V.P., in the Chair.

There were about thirty members present.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society :—

William Barraclough, No. 2, Yurong-street.
John Cameron, Bourke.
J. S. Chard, Stanmore Road.
Wm. J. Walter Neill, City Bank.
Dr. Maurice O'Connor, 80, William-street.
Thos. F. G. Pockley, Commercial Bank, Goulburn.
E. B. Woodhouse, Mount Gilead, Campbelltown.

The certificates of six new candidates were read.

The CHAIRMAN stated that the Council recommended the election of the following gentlemen as honorary members of the Society :—

Darwin, Dr. Charles, F.R.S., M.A., F.G.S., F.L.S., &c. &c., Beckenham, Kent.

Huxley, Professor, F.R.S., LL.D., F.G.S., F.Z.S., F.L.S., &c., &c., Professor of Natural History in the Royal School of Mines, South Kensington, London.

Owen, Professor, C.B., M.D., D.C.L., LL.D., F.R.S., F.G.S., V.P.Z.S., &c., &c., The British Museum, London, W.C.

The election was duly carried.

The following letters were read :—

Mr. H. C. Russell to Professor Liversidge.

My dear Sir, Sydney Observatory, 7 July, 1879.

It will be within the recollection of some of the members of the Council of the Royal Society that I very reluctantly, and in fact only when others declined the office, consented to be nominated as Honorary Treasurer this year.

Nevertheless when the Society elected me, I was not insensible of the honor which had been conferred upon me, and consented to act, because I then thought that all the members wished me to do so; and that by acting, I should to a small extent be serving the Society, although I knew the duties must be performed at the frequent sacrifice of personal convenience.

Since then we have had several discussions upon the bye-laws, and during these some of the members have made remarks about the Council that I feel to be equivalent to censure.

Personally I have endeavoured, as I believe every other member of the old Council has done, to carry out the rules and bye-laws, simply and solely for the good of the Society, and I am not conscious of any act as a member of the Council which can justly be visited with censure.

I should be sorry to question the right of members to criticize the acts of the Council, but I very much question the expediency of doing so, in the tone recently adopted by some of the younger members of the Society, and I certainly cannot consent to hold an honorary office subject to such criticism.

I beg therefore that this letter may be taken as the resignation of my position as Honorary Treasurer and ex-officio member of the Council.

I reserve however my rights as one of the trustees of the Society's house.

Believe me yours faithfully,
H. C. RUSSELL.

Professor Liversidge to H. C. Russell, Esq., B.A., Government Astronomer.

My dear Sir, The Society's House, Sydney, 31 July, 1879.

Your letter of the 7th instant, in which you resign the Honorary Treasurership and your seat on the Council of this Society, was duly laid before the Council at the meeting held this afternoon.

The Council received your intimation with extreme regret, and are much concerned that you should have had reason to withdraw from the management of the Society, especially as it feels that so much of the present prosperity and usefulness of the Society is due to the constant and untiring exertions which you, one of the oldest members of the Council, have ever made to promote the objects and interests of the Society; and I am requested to beg that you will kindly reconsider the matter, and that should you find it impossible to act as Honorary Treasurer that you will not refuse to retain your seat on the Council Board.

With the greatest respect,
I am, my dear Sir,
Yours truly,
ARCHIBALD LIVERSIDGE,
Hon. Sec.

Mr. H. C. Russell to Professor Liversidge.

My dear Sir, Sydney Observatory, 5 August, 1879.

Your letter of July 31st, in which you so kindly express the wish of the Council that I should retain a seat at the Council Board, I duly received.

But, while deeply sensible of the compliment paid to me by the Council, I must decline to accept a seat on the Council Board. My reason for doing so is similar to that which induced me to resign the position of Honorary Treasurer, viz. : that I cannot consent to occupy a seat upon the Council subject to such criticism as that which has recently been applied to that body by certain younger members of the Society.

Yours faithfully,
H. C. RUSSELL.

Professor Liversidge announced that the Council had elected H. G. A. Wright, Esq., M.R.C.S., as Honorary Treasurer, until the next annual meeting.

The Chairman stated that some copies of the following publications were available for distribution to public institutions upon application, viz. :—

Brazilian Biographical Annual, in 3 vols.
The Argentine Republic.
Portugal—Agricultural and Colonial Exhibitions at Philadelphia.

Forty-two donations were laid upon the table.

The following letter from Baron von Mueller, K.C.M.G., was read :—

Baron von Mueller to Professor Liversidge.

Melbourne, 20 July, 1879.

It is my pleasing duty, honored sir, to acknowledge the receipt of your communication of the 4th of this month (just arrived), in which the Royal Society of New South Wales deemed me worthy of its kind felicitation, at the conclusion of the "Flora Australiensis," a work which engaged the almost unparalleled zeal and genius of the venerable George Bentham for sixteen years, and in which work I had the honor to be his main collaborator.

Among all the rewards which have been so generously bestowed on the researches in which I have been engaged during nearly a third of a century in Australia, I regard the appreciation expressed by the Royal Society of New South Wales as one of the highest. I am all the more touched with this unexpected mark of consideration, evinced by the gentlemen of learning united in your Society, as in reality I have individually so little claim on their kindliness; but my rejoicing at such a friendly encouragement becomes intermingled with some sadness when I reflect how infinitely more I could have served all the Australian dominions, had the substantial support afforded to my researches been commensurate with all the intended plans formed originally for my work.

May Providence grant me health and strength to satisfy the great expectations raised, in regard to the continuation of my literary efforts, and the original observations on which they must be based.

If, in the autumn of my life, I can shed also light on the still unexplored portions of the fifth continent, in reference to the vegetable beings with which it has been endowed by an Almighty will and power, then one of the main objects of my life will be realized.

With my expressions of reverence to the Royal Society of New South Wales, I remain also your regardfully attached,—

FERD. VON MUELLER.

The report of the Bye-law Committee was read, and laid upon the table for adoption.

It was resolved that the proposed alterations to the rules and bye-laws be printed and distributed to the members, and their further consideration be deferred.

The Rev. W. Hey Sharp, M.A., then read a paper on "The Water of Sydney Harbour."

Professor Liversidge in the absence of the author, the Rev. J. E. Tenison-Woods, F.G.S., read a paper on "The Anatomy of Distichopora, a recent discovery in Natural Science."

WEDNESDAY, 3 SEPTEMBER, 1879.

ORDINARY MONTHLY MEETING.

Hon. J. Smith, C.M.G., V.-P., in the Chair.

There were about fifty members present.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society :—

Joseph Campbell, St. Paul's College, Darlington.

Edward Lytton Hitchins, Florence, Victoria-street, Darlinghurst.

Andrew Houison, 128, Phillip-street.

James Inglis, Redmyre.

James Monsell Spry, Union Club.

F. R. Wilshire, Berrima.

The certificates of six new candidates were read.

It was moved that the amendments proposed by the Bye-law Committee be now adopted, subject to such corrections as the Committee may think necessary.

The motion was duly carried, there being only two dissentients.

The Chairman announced that the Council had elected Mr. Robert Hunt, F.G.S., Deputy Master of the Mint, a member of the Council for the remainder of the year, to fill the vacancy caused by the appointment of Mr. H. G. A. Wright, M.R.C.S., as Honorary Treasurer, *vice* Mr. Russell resigned.

Thirty-nine donations were laid upon the table.

Dr. Hector, C.M.G., F.R.S., then delivered a lecture on the "Geology of New Zealand."

Mr. W. A. Dixon, F.C.S., exhibited a substance called "uranine," a very small particle of which when dropped into water produces a remarkable green fluorescence.

WEDNESDAY, 1 OCTOBER, 1879.

ORDINARY MONTHLY MEETING.

Hon. J. Smith, C.M.G., V.-P., in the Chair.

There were about forty members present.

The minutes of the last meeting were read and confirmed

The following gentlemen were duly elected ordinary members of the Society:—

Thomas Brindley, Nepean Cottage, Bourke-street, Redfern.
Wilfrid L. Docker, Craigstone, William-street South.
R. G. Higgins, Clifford, Potts's Point.
John Trevor Jones, 356, Liverpool-street.
Edward Masters, Lurlei, Marrickville.
John Francis Mullins, M.A., Macquarie-street.

The certificates of nine new candidates were read.

Twenty-nine donations were laid upon the table.

It was resolved that the rules, as amended, and which had been agreed to at the last meeting, be adopted.

The disposal of the Clarke Memorial Fund was then considered, and the Chairman stated that it was the intention of the Council to proceed with one of the two schemes that had been propounded, the first of which was that a medal, to be called the Clarke Memorial Medal, should be awarded for meritorious contributions to the Geology, Mineralogy, or Natural History of Australasia, to be open to men of science, whether resident in Australasia or elsewhere.

The second was to establish a lecture, to be called the Clarke Memorial Lecture.

He said the reason they had not moved in the matter before was because the amount collected had not come up to their expectations, and since they found that they could not have the two, the opinion of the Council was to begin with the medal, which he thought should be of gold in preference to bronze.

It was moved "that the Council be authorized to procure a die for the Clarke Memorial Medal, such medal to be of gold, and of the value of £10."

Mr. Henry advocated the substitution of a scholarship in the University for the medal, but the Chairman said that as the matter had already been fully discussed and negatived it was no use re-opening the subject.

The resolution was duly carried.

Professor Liversidge then read a paper by Hyde Clarke, Esq., Vice-President of the Anthropological Institute, London, on "The Languages of Australia in their connection with those of Mozambique and of the South of Africa."

Several photographs of the interior of the Canterbury Museum were exhibited by Dr. von Haast, and presented by him to the Society.

Mr. Wilkinson, Government Geologist, exhibited some specimens of serpentine rock containing gold, discovered at Gundagai, while the finder was in search of asbestos. He stated that he had received with the specimens a letter from the digger, enclosing a nugget of gold about a quarter of an ounce in weight, found on

top of a serpentine rock. He thought it was a discovery of very great importance, because serpentine rock was found not only in dykes, but in mountain masses; and there was no knowing to what extent they might find deposits of this kind containing gold. The discovery was also of remarkable interest, inasmuch as gold had never before been found in serpentine; and as one of the specimens had a transverse fracture with gold in its centre, he concluded that gold would be obtained, not only upon the surface of the rock, but running right through it. About 20 tons of this rock had been broken, and it was intended to have put it through a crushing machine, and otherwise treated as quartz. He purposed getting some more of the specimens and presenting some of them to the Society. Mr. Wilkinson also exhibited a specimen of petrified wood obtained by Mr. Bennett while excavating for the foundation of the bridge being erected over the Parramatta River. It was found at a depth of 40 feet below the bed of the river. This, he thought, taken with other evidence, was a proof that Sydney Harbour was a sunken river valley. In sinking the first 30 feet shells and other deposits were passed through, and below this the petrified wood which was a river deposit was found. The discovery was of very great practical importance, as it went to prove that portions at least of Sydney Harbour were once a dry valley; and if Sydney Harbour was a sunken valley the Botany dams were the same, but had been filled up with sand. He had no doubt that if they were to bore in the neighbourhood of Newtown and Botany they would strike a very good supply of water, which would be artesian.

Dr. Von Haast said he never thought that the theory of Sydney Harbour was a sunken river valley was ever doubted; it was proved unmistakeably to his mind, after inspecting the river terraces shown in Darling Harbour and elsewhere. He also considered the discovery of gold in serpentine rock to be of great importance, as something hitherto unheard of in any part of the world.

Professor Liversidge said the form of this gold closely resembled that presented by gold from certain parts of Hungary. The rock was not exactly that known as serpentine but marmolite, which is a serpentinous mineral, possessing a fibrous and somewhat lamellar structure. He did not think that the physical structure of Darling Harbour corresponded to that of river terraces; as far as he could see, the outlines were due principally to changes in the structure and composition of the rock. In the sandstone they had a compact stone, overlaid perhaps by a layer of shalely sandstone, and above that there was in some instances a sandstone which was strongly marked by false bedding. Both the false bedded sandstone and the shale weather more quickly than the compact sandstone; they recede and finally leave a shelf somewhat but very distantly resembling a river terrace.

Mr. WILKINSON also thought that the geological formations of Darling Harbour were due to the changes which the different stratas underwent. The only evidences of river deposits were those from which the piece of fossil wood exhibited came.

The meeting then adjourned.

WEDNESDAY, 22 OCTOBER, 1879.

The annual Conversazione given by the Society was held in the Great Hall of the University, on the evening of October 22nd, 1879, at 8 p.m.

The guests, who were received in the Great Hall by the Vice-presidents and Members of the Council, amounted in number to close upon 900, the attendance being considerably greater than on any previous occasion.

Amongst the visitors were the members of the various Foreign and Colonial Commissions to the Sydney International Exhibition, and many others who had been attracted to Sydney by the Exhibition.

The Hall and its approaches were tastefully decorated with palms, ferns, and rare plants by Mr. C. Moore, F.L.S., Director of the Botanic Gardens.

The general arrangements were under the direction of a Committee composed of Professor Liversidge, Messrs. C. Moore, H. C. Russell, Hirst, and Montefiore. A selection of music was played during the evening.

Dr. HECTOR, F.R.S., C.M.G., the Executive Commissioner for New Zealand, showed by the lime light a most interesting series of beautiful photographs of New Zealand scenery.

Amongst the chief exhibits were a new form of governor for a driving-clock, regulated by means of a series of four pendulums, made and exhibited by Mr. H. C. Russell, Government Astronomer; also a series of thermometers, made by Hicks, of London, in which each degree is about 1½ inch long, and divided into fiftieths of a degree centigrade.

The University exhibited Cailletet's apparatus for the liquefaction of the so-called permanent gases; the action of the instrument was shown from time to time during the evening by liquefying carbonic acid gas; also a Christie's half-prism spectroscope; a series of rock-crystal weights, from the kilogramme downwards; and a large number of new pieces of physical and chemical apparatus; also several fine and unusual chemical preparations.

Mr. G. M. STEPHEN, F.G.S., exhibited a large series of Australian gem stones; Mr. Cracknell, Superintendent of Telegraphs, showed a large collection of telegraph instruments of a most interesting character, including one of the first instruments made by Cooke and Wheatstone and used for public purposes.

PROFESSOR LIVERSIDGE exhibited a series of about 200 old and modern books relating to Australia and New Zealand.

Mr. MACDONNELL contributed a very large and interesting collection of electrical apparatus at work.

NAMES OF EXHIBITORS AT CONVERSAZIONE, 1879.

Dr. Belgrave,
Mr. M. A. Black,
,, H. J. Bolding,
,, G. Butterfield,
,, Joseph Campbell,
,, J. S. Chard,
Dr. Clune,
Mr. George Colquhoun,
,, E. C. Cracknell,
,, J. V. Dalgarno,
,, S. De Lissa,
,, James Douglas, M.R.C.S.,
Messrs. Flavelle Brothers & Roberts,
Mr. R. Fraser,
,, E. H. Fry,
,, C. Louis Gabriel,
,, W. R. George,
,, H. A. Gilliat,
,, T. Richards, Govt. Printer,
,, R. T. Hall,
,, L. Hargrave,
,, L. W. Hart,
Dr. Hector, C.M.G., F.R.S.,
Mr. Thomas Hewett,
,, G. D. Hirst,
Rev. James Jefferis, LL.B.,
Mr. P. G. King,
,, F. B. Kyngdon,
Professor Liversidge,
Mr G. A. Lloyd,
,, W. MacDonnell,
,, W. J. MacDonnell, F.R.A.S.,
Rev. Peter MacPherson, M.A.
Mr. G. E. Makin,
,, Robert Marklove,
Rev. George Martin,
Messrs. Mayer & Metzler,
Dr. F. Milford,
Mr. E. L. Montefiore,
,, F. H. Moore,
Dr. Morris,
The Trustees of the Museum.
Mr. Hugh Paterson,
Dr. Paterson,
Mr. Perceval Pedley,
,, R. B. Read, M.R.C.S.,
,, P. E. Reynolds,
Royal Society, N.S.W.,
Mr. H. C. Russell, B.A., F.R.A.S.,
,, Henry Sharp,
Rev. W. Hey Sharp,
Mr. J. T. Toohey,
Dr. Tucker,
Mr. H. O. Walker,
University of Sydney.

WEDNESDAY, 5 NOVEMBER, 1879.

ORDINARY MONTHLY MEETING.

HON. J. SMITH, C.M.G., V.-P., in the Chair.

There were about fifty members present.

The minutes of the last meeting were read and confirmed.

The following gentlemen were duly elected ordinary members of the Society:—

Fred. J. Armstrong, Winthrop, Nelson-street, Woollahra.
Samuel Davenport, Executive Commissioner to the Sydney International Exhibition, Adelaide, South Australia.
James W. Johnson, Brooksby, Double Bay.
Adrian Mountain.
Edward Fisher Pittman, L.S., Department of Mines.
Septimus Stephen, South Kingston.
Harman Tarrant, M.R.C.S., Elizabeth-street.
Charles Lamb Taylor, M.R.C.S., 14, College-street.
Lewis Whiteld, B.A., Grammar School.

The certificates of five new candidates were read for the first time.

Eighty-three donations were laid upon the table.

An enlarged photograph of the late Rev. W. B. Clarke was presented to the Society by Mr. Freeman.

A paper illustrated by the oxyhydrogen lantern was read by Mr. L. W. Hart, on "Photography in its relation to popular Education."

The leaf of a fossil aquatic plant (*Ottelia præterita*) obtained by Mr. F. Griffin, from Parramatta, was exhibited by Professor Liversidge, who read a description of the same by Baron von Mueller, K.C.M.G., F.R.S., &c., &c.

WEDNESDAY, 3 *DECEMBER*, 1879.

ORDINARY MONTHLY MEETING.

Hon. J. SMITH, C.M.G., V.-P., in the Chair.

There were between forty and fifty members present.

The minutes of the last meeting were read and confirmed.

Robert Etheridge, jun., Esq., F.G.S., was elected a corresponding member of the Society.

The certificates of five new candidates were read for the second time, and of four for the first time.

The CHAIRMAN stated that the Council had re-considered the matter of the Clarke Memorial Medal, and recommended that it be made of bronze instead of gold as originally intended, partly in consideration of the feelings of Mr. Clarke's family upon the subject; the medal also could be increased in size, to afford the artist more scope for the design. It was thought, too, that bronze was a more suitable metal, and the diminished annual expense would leave more of the fund free for other purposes in connection with the memorial.

It was proposed by Mr. R. HUNT that so much of the resolution passed at the previous meeting as provided that the medal should be of gold be rescinded.

The resolution was duly carried.

Messrs. R. A. A. Morehead and A. S. Webster were appointed Auditors of the accounts to be laid before the Society at the annual meeting.

Forty-four donations were laid upon the table.

The following letter from George Bentham, C.M.G., F.R.S., was read :—

25, Wilton Place, London, S.W.,
3 October, 1879.

My dear Sir,

I have to acknowledge yours of the 4th July, received yesterday, informing me that I have been elected an honorary member of the Royal Society of New South Wales. I beg you will express to the Society how much I feel gratified by the honor they have conferred upon me, and to accept for yourself my thanks for the very flattering terms in which you have made the communication.

I remain, my dear sir,
Yours, very sincerely,
GEORGE BENTHAM.

To Prof. Liversidge.

In the absence of Mr. H. S. Hawkins, M.A., Prof. LIVERSIDGE read some extracts from a paper on "A Catalogue of Latitude Stars."

Mr. C. S. WILKINSON gave a *résumé* of his paper on "Some remarkable Boulders in the Hawkesbury Beds."

A paper was also read by Mr. H. C. RUSSELL, B.A., F.R.A.S., entitled, "Remarks upon the Wentworth Hurricane in January."

ADDITIONS

TO THE

LIBRARY OF THE ROYAL SOCIETY OF NEW SOUTH WALES.

DONATIONS—1879.

(The names of the Donors are in *Italics.*)

REPORTS, OBSERVATIONS, &c.

ADELAIDE :—Transactions and Proceedings and Report of the Philosophical Society of Adelaide, South Australia, for 1877–78.
Anniversary Address of the President, Prof. Ralph Tate, F.G.S. *The Society.*
The Adelaide University Calendar for 1879.
Do. 1880. *The Registrar.*
Report of the Progress and Condition of the Botanic Garden and Government Plantations, Adelaide, during the year 1878. *Dr. Schomburgk.*
Meteorological Observations made at the Adelaide Observatory, May, June, July, August, September, October, November, and December, 1878. *The Government Observer.*
South Australian Institute Annual Report, 1878-9. *The Institute.*

AMSTERDAM :—Verslagen en Mededeelingen der K. Akademician Wetten-schappen Afd. Natuurkunde Tweede Reeks Deel, I–XIII (incl.) *The Royal Academy of Sciences, Amsterdam.*

AUCKLAND :—Report of the Auckland Institute for 1878–79. *The Institute.*

BERLIN :—Monatsbericht der Koeniglich Preussischen Akademie der Wissenschaften zu Berlin. January, February, March, April, May, June 1879. *The Academy*

BONN :—Verhandlungen des Naturhistorischen Vereines der Preussischen Rheinlande und Westfalens.
Dreiunddreissigster Jahrgang Vierte Folge 3 Jahrgang 1 Hälfte.
Vierunddreissigster „ „ „ 4 1 & 2 „
Fünfunddreissigster „ „ „ 5 1 „
The Society.

BRUSSELS :—Bulletins de l'Académie Royale de Belgique.
2nd ser., Tome XLI, XLII, 1876.
„ XLIII, XLIV, 1877.
„ XLV, 1878.
Annuaire de l'Académie Royale de Belgique, 1877 and 1878. *The Royal Academy.*

CALCUTTA :—

Scientific Results of the Second Yarkand Mission—

Reptilia and Amphibia, by W. T. Blanford, F.R.S. (Two plates.)

Geology, by W. T. Blanford, F.R.S.

Mollusca, by Geoffrey Neville, C.M.G.S. (One plate.)

Ichthyology, by Francis Day, F.L.S., F.Z.S. (Five plates.)

Neuroptera, by Rev. Robert M'Lachlan, F.R.S., F.L.S.

Hymenoptera, by Fred. Smith. (One plate.)

Mammalia, by W. T. Blanford, F.R.S. (Sixteen plates.)

Lepidoptera, by Frederick Moore, F.Z S. (One plate.)

Syringosphæridæ, by Prof. P. Martin Duncan, M.B., F.R.S. (Three plates.)

The Registrar, Home Revenue and Agricultural Dept., Calcutta.

Memoirs of the Geological Survey of India—

Vol. XIV.

XV. Part 1.

(Palæontologia Indica) Series XII. Part 1.

„ Part 4, No. 3.

Records of the Geological Survey of India—

Vol. XI. Parts 1, 2, 3, 4, and Index to Volumes I to X.

XII. Part 1.

Geology of India. Part 1. Peninsular Area.

„ „ Part 2. Extra-Peninsular Area.

„ „ Map.

H. B. Medlicott, Superintendent, Geological Survey of India.

Journal of the Asiatic Society of Bengal—

Vol. XLVII. Nos. 216, 217, 218, 219, 220, 221, 222, 223. New Series.

XLVIII. No. 224.

Proceedings of the Asiatic Society of Bengal—

Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. 1878.

Nos. 1, 2, 3, 4.

List of Publications in the Library of the Asiatic Society of Bengal, 1878.

The Society.

CAMBRIDGE :—Transactions of the Cambridge Philosophical Society—

Vol. XII. Parts 1, 2, 3.

Proceedings of the Cambridge Philosophical Society—

Vol. III. Parts 1, 2, 3, 4, 5, 6. *The Society.*

CAMBRIDGE (Mass.), U.S.A. :—

Bulletin of the Museum of Comparative Zoology—

Vol. V. Nos. 11, 12, 13, 14. *The Museum.*

CASSEL :—Uebersicht der bisher in der Umgegend von Cassel beobachteten Pilze.

Catalog der Bibliothek des Vereins fur Naturkunde in Cassel.

Die Lebensgeschichte der auf Ulmus campestris L. vorkommenden Aphiden—Arten, &c., by Dr. Hermann F. Kessler.

Verein für Naturkunde, Cassel.

CHEMNITZ (Saxony) :—Sechster Bericht der Naturwissenschaftlichen Gesellschaft zu Chemnitz, from 1st January, 1875, to 31st December 1877. (Three plates.) *The Society.*

DRESDEN :—Jahresbericht des Vereins für Erdkunde zu Dresden—

XIII. and XIV.

XV.—Wissenschaftlicher Theil, 1878.

XV.—Geschäftlicher Theil und Sitzungsberichte. *The Society.*

Zeitschrift des K. Sächsischen Statistischen Bureaus—

XXIV. Heft 1 and 2. *The Bureau.*

DUBLIN :—Proceedings of the Royal Irish Academy—
Vol. I. Ser. 2. Nos. 12, 13.
II. „ Nos. 1, 2, 3, 7.
III. „ Nos. 1, 2, 3.
The Transactions of the Royal Irish Academy—
Vol. XXV. Nos. 10, 11, 12, 13, 14, 15, 16, 17, 18, 19.
XXVI. Nos. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21.
XXVII. Nos. 1, 2, 3. *The Academy.*

EDINBURGH :—Proceedings of the Royal Physical Society, Sessions 1876–78.
Proceedings of the Royal Society of Edinburgh, Session 1877–78. *The Society.*
Transactions of the Edinburgh Geological Society. Vol. III. Part 3. *The Society.*

FRANKFURT *a. M.* :—Abhandlungen von der Senckenbergischen naturforschenden Gesellschaft. Band XI. Heft 2 and 3. (Twenty-one plates.)
Bericht uber die Senckenbergische Naturforschende Gesellschaft, 1876–1877, 1877–1878. *The Society.*

FREIBURG IN BADEN :—Berichte über die Verhandlungen der Naturforschenden Gesellschaft zu Freiburg. 1 B. Band VII. Heft 3. *The Society.*

GENEVA :—Mémoires de l'Institut National Génevois, Tome Quatorzième, 1878–79. *The Institute.*

GLASGOW :—The Glasgow University Calendar for the year 1879–80. *The University.*

GORLITZ :—Abhandlungen der Naturforschenden Gesellschaft zu Görlitz. Band XVI. *The Society.*

HAARLEM :—Archives du Musée Teyler.
Vols. I, II, III, IV. Parts 1–4.
Vol. V. Part I.
Les Directeurs de la Bibliothèque du Musée Teyler.
Archives Néerlandaises des Sciences Exactes et Naturelles. Tome XIII. Liv. 4, 5. *The Society.*

HAMBURG :—Verhandlungen des Vereins für Naturwissenschaftliche Unterhaltung zu Hamburg, 1876. *The Society.*
Mittheilungen der Geographischen Gesellschaft in Hamburg, 1878–79. Heft 1. *The Society.*

HOBART TOWN :—Papers and Proceedings and Report of the Royal Society of Tasmania for 1877. *The Society.*

JENA :—Jenaische Zeitschrift für Naturwissenschaft herausgegeben von der Medicinisch—Naturwissenschaftlichen Gesellschaft zu Jena.
XII. Band N.F. 5, Bd. 4
XIII. „ 6 „ 1, 2, 3, 4. *The Society.*

LAUSANNE :—Bulletin de la Société Vaudoise des Sciences Naturelles.
Vol. XV, No. 80. *The Society.*
XVI, Nos. 81 and 82.

LEEDS :—Fifty-eighth Annual Report of the Leeds Philosophical and Literary Society for 1877–78. *The Society.*
Fifth Annual Report, Yorkshire College of Science, Leeds, 1878–79. *The College.*

LIVERPOOL :—Proceedings of the Literary and Philosophical Society of Liverpool.
Vol. XXXII, 1877–8. *The Society.*

LIEGE :—Annales de la Société Géologique de Belgique.
Tome 4. 1877. *The Society*

LILLE :—Bulletin Scientifique du Département du Nord. Nos. 8 & 9, August and September, 1878.
Eight Pamphlets by Prof. M. A. Giard.
Société Géologique du Nord.
Annales V. 1877–1878. *The Society.*

LUXEMBOURG :—Publications de l'Institut Royal Grand-Ducal de Luxembourg (Section des Sciences Naturelles).
Tome XVII. *The Institute.*

LONDON :—Monthly Notices of the Royal Astronomical Society.
Vol. XXXVIII. No. 9.
XXXIX. Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9.
List of Fellows, Royal Astronomical Society, June, 1879.
Memoirs of the Royal Astronomical Society.
Vol. XLIV, 1877–79. *The Society.*
Journal of the Royal Microscopical Society.
Vol. I. Nos. 5, 6.
II. Nos. 1, 2, 3, 4, 5. *The Society.*
Roll of the Royal College of Physicians.
Vol. I. A.D. 1518 to 1700.
II. „ 1701 to 1800.
III. „ 1801 to 1825.
The Royal College of Physicians.
Proceedings of the Royal Colonial Institute.
Vol. X. 1878–79.
England and her Colonies at the Paris Exhibition, by Fred. Young, Esq.
The Institute.
The Journal of the Anthropological Institute of Great Britain and Ireland.
Vol. VIII. Nos. 1, 2, 3, 4.
IX. No. 1. *The Institute.*
Quarterly Journal of the Meteorological Society.
Vol. IV. No. 28.
V. Nos. 29, 30, 31.
List of Fellows of the Meteorological Society, May 1, 1879.
The Society (per favour of the Agent General).
Proceedings of the Physical Society of London.
Vol. II, Part V, July to December, 1878.
III, Part I, January to June, 1879. *The Society.*
Journal of the Royal United Service Institution.
Appendix to Vol. XXI.
Index of the Lectures and Papers contained in Vols. XI–XX.
Vol. XXII. Nos. 94, 95, 96, 97, 98, 99.
Appendix to Vol. XXII.
Vol. XXIII. Nos. 100, 101. *The Institution.*
Proceedings of the Royal Geographical Society.
Vol. I. Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. *The Society.*
Proceedings of the Royal Society.
Vol. XXVIII. Nos. 190, 191, 192, 193, 194, 195.
XXIX. Nos. 196, 197. *The Society.*
The Journal of the Royal Asiatic Society of Great Britain and Ireland.
New Series. Vol. XI. Parts I and II. *The Society.*
The Journal of the Quekett Microscopical Club.
Nos. 36, 37, 38, 39, 40. *The Club.*
Royal Historical Society's Transactions. Vol. VII. *The Society.*
The Calendar of the Pharmaceutical Society of Great Britain, 1879.
Catalogue of the Pharmaceutical Society of Great Britain. 1874.
The Society.

LONDON—*continued.*

The Pharmaceutical Journal and Transactions.

Third Series. Parts 97, 98, 99, 100, 101, 102. 1878.

Third Series. Parts 103, 105, 108, 109, 110, 111, 112. 1879.

The Society.

Charter, By-laws, and Regulations, and List of Members of the Institution of Civil Engineers. *The Institution.*

Report of the Permanent Committee at Utrecht, of the first International Congress at Vienna. Contributions to our knowledge of the Meteorology of the Arctic Regions. Part I. *The Meteorological Office.*

Proceedings of the Royal Institution of Great Britain.

Vol. VIII. Parts V, VI. *The Institution.*

The Journal of the Linnean Society.

Zoology. Vol. XIV. Nos. 76, 77, 78, 79, 80.

Botany. Vol. XVII. Nos. 99, 100, 101, 102.

List of the Linnean Society of London. 1878. *The Society.*

MADRID:—Revista de los Progresos de las Ciencias Exactas, Fisicas, y Naturales Tomo 19. Nos. 1, 2, 3, 4, 5.

Senor Antonio de la Camara, Consul General for Spain in Melbourne.

MANCHESTER:—Transactions of the Manchester Geological Society.

Part XVII, Vol. XIV. *The Society.*

MARBURG:—Beiträge zur Kenntniss der Scolopendriden, by Ernst Kohlrausch.

Medical Theses. *The University.*

MELBOURNE:—Transactions and Proceedings of the Royal Society of Victoria.

Vol. XV. *The Society.*

Results of Observations and Meteorology, &c., taken at the Melbourne Observatory during year 1876.

Vol. V., by R. L. J. Ellery, F.R.S., F.R.A.S.

The Government Astronomer.

The Melbourne University Calendar for the Academic Year 1878–80.

The Chancellor.

Reports of the Mining Surveyors and Registrars.

Quarter ended 30 Sept., 1878.

" " 31 Dec., 1878.

" " 31 Mar., 1879.

" " 30 June, 1879.

" " 30 Sept., 1879.

Report of the Chief Inspector for Mines for the year 1878.

Geological Survey of Victoria, No. V. Report of progress.

The Hon. the Minister of Mines.

Melbourne International Exhibition.

List of Commissioners, Regulations, &c. *The Commissioners.*

Historical Records of Port Phillip. *The Chief Secretary.*

Statistical Register of the Colony of Victoria for the year 1877.

Part VII. Law, Crime, &c.

Part VII. Interchange.

Part IX. Religious, Moral and Intellectual Progress.

Index to Statistical Register for 1877.

Statistical Register of the Colony of Victoria for the year 1878.

Part I. Blue Book.

II. Population.

III. Finance, &c.

IV. Vital Statistics, &c.

V. Law, Crime, &c.

VI. Production.

VII. Accumulation. *The Government Statist.*

MELBOURNE—*continued.*
Statistics of Friendly Societies for the years 1877 and 1878.
Victorian Year Book for 1878–9.
Australian Statistics for the year 1878. *The Government Statist.*
Index of Patents and Patentees (Victoria).
Vol. X, for 1875. *The Registrar General.*

METZ :—Erster Jahresbericht des Vereins für Erdkunde zu Metz for 1878. *Verein für Erdkunde.*

MIDDLESBORO' :—The Journal of the Iron and Steel Institute.
No. 2, 1878.
No. 1, 1879. *The Institute.*

MODENA :—Memorie della Regia Accademia di Scienze, Lettere ed Arti in Modena. Tomo XVIII. *The Academy.*

MOSCOW :—Bulletin de la Société Imperiale des Naturalistes de Moscow.
Nos. 3 and 4, 1878. *The Society.*
No. 1, 1879.

MULHOUSE :—Bulletin de la Société Industrielle de Mulhouse.
Dec. 1878, and Supplement to Dec. 1878.
Jan., Feb., Mar., April, May, June, Aug., Sept., 1879. *The Society.*

MUNICH :—Sitzungsberichte der Mathemat.-physik. Classe der k. b. Akademie der Wissenschaften zu München. 1878, Heft. 1, 2, 3, 4.
Abhandlungen der Mathemat.-physik. Classe der Königl bayerischen Akademie der Wissenschaften. Band XIII., Abth. II.
Ueber die Chemische Synthese, by Dr. Adolf Bayer. *The Academy.*

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Twenty Maps of New Caledonia.
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(Names of Donors in *Italics*.)

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Broeck, Ernest Van den. Instructions pour la Récolte des Foraminifères vivants. *Prof. Liversidge.*
Cooke, Dr. M. C.: Songs written for the Excursionists' Annual Dinners. Quekett Microscopical Club. *F. Crisp, B.A.*
Cuvier, G.: Lectures on Comparative Anatomy. Vols. I and II.
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Vol. I. A Summary or Index of Measurements of certain Stars.
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Haast, Dr. von, F.R.S.:
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The Native Plants of Victoria. Part I.
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Third Decade.
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Orpen, J. M., M.L.A. (Cape Town). Our Relations with the Imperial Government and Confederation. *W. Foster & Co.*
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Waiwera Hot Springs, near Auckland, N.Z. *E. A. Isaacs.*
Waters, Arthur W., F.L.S., F.G.S. On the Bryozoa (Polyzoa) of the Bay of Naples. *The Author.*
Whitehead, James, M.D.: Notes on the Rate of Mortality in Manchester. *Prof. Liversidge.*
Williams, Rev. James: The Manual of Alethography, being an Improved System of Short-hand. *Prof. Liversidge.*

Donations to the Society's Cabinets, 1879.

1 whetstone, 1 hatchet, 3 fragments of hatchets, and 3 fragments of bone. *R. H. Mathews, Esq.*
An enlarged Photograph of the late Rev. W. B. Clarke, M.A., F.R.S., in gilt frame. *Mr. Freeman.*

PERIODICALS PURCHASED IN 1879

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Analyst.
Annales des Chimie et Physique.
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Athenæum.
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English Mechanic.
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Journal of the Chemical Society.
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,, ,, Society of Arts.
Lancet.
L'Art.
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Nature.
Notes and Queries.
Philosophical Magazine.
Popular Science Review.
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Proceedings of the Geological Association.
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Telegraphic Journal.
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Beale's How to work with a Microscope.
Encyclopædia Britannica. Vols. 9 and 10.
Flammarion's Atmosphere.
Johnston's Royal Atlas.
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Kerl's Metallurgy. 3 vols.
Ogilvie's English Dictionary.
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Tauchnitz's Dictionary of Technical Terms.
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EXCHANGES AND PRESENTATIONS

MADE BY THE

ROYAL SOCIETY OF NEW SOUTH WALES.

* Exchanges of Publications have been received from the Societies and Institutions distinguished by an asterisk.

In the following List the Publications are indicated by numerals as follows:—

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,, 2.—Report of the Council of Education of New South Wales, 1878.
,, 3.—Report of the Mining Department of New South Wales, 1877.

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Albany.—New York State Library, Albany. Nos. 1, 2.

Annapolis (M.D.)—Naval Academy. No. 1.

Baltimore.—Johns Hopkins' University. Nos. 1, 2.

Boston.—*American Academy of Science. No. 1.
,, *Boston Society of Natural History. No. 1.

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Davenport (Iowa).—*Academy of Natural Sciences. No. 1.

Hoboken (N.J.)—The Stevens' Institute of Technology. No. 1.

Minneopolis.—Minnesota Academy of Natural Sciences. No. 1.

New York.—American Chemical Society. No. 1.
,, *American Geographical Society of New York. No. 1.
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,, School of Mines, Columbia College. No. 1.

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Philadelphia.—*Academy of Natural Science. No. 1.
,, *American Entomological Society. No. 1.
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,, *Franklin Institute. Nos. 1, 2.
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Salem (Mass.)—Peabody Academy of Sciences. No. 1.
,, *Essex Institution. Nos. 1, 2.

St. Louis.—*Academy of Sciences. No. 1.

Washington.—*Commissioner for Agriculture. No. 1.
,, *Dr. F. V. Hayden, Geological Survey of Territories. Nos. 1, 2.
,, *Hydrographic Office. Nos. 1, 2.
,, *Smithsonian Institute. Nos. 1, 2.
,, *War Department. No. 1.
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,, *Director of the Mint (Treasury Department). Nos 1, 2.
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,, *The Secretary (Navy Department). No. 1.
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,, *The Secretary (Department of the Interior). Nos. 1, 2.
,, *U. S. National Museum (Department of the Interior). Nos. 1, 2.
,, *Bureau of Education (Department of the Interior). Nos. 1, 2.
,, *Office of Indian Affairs (Department of the Interior). No. 1.
,, *Surgeon-General (U.S. Army). Nos. 1, 3.
,, *Chief of Engineers (U.S. Army). Nos. 1, 3.

AUSTRIA.

Prague.—*Königlich böhmische Gesellschaft der Wissenschaften. Nos. 1, 2.

Trieste.—*Societe Adriatica di Scienze Naturale. Nos. 1, 2, 3.

Vienna.—Anthropologische Gesellschaft. Nos. 1, 3.
,, Geographische Gesellschaft. No. 1.
,, *Geologische Reichsanstalt. No. 1.
,, *Kaiserliche Akademie der Wissenschaften. Nos. 1, 2.
,, *Œsterreichische Gesellschaft für Meteorologie. Nos. 1, 3.
,, *Zoologisch-Botanische Gesellschaft. No. 1.
,, *K. K. Central-Anstalt für Meteorologie und Erdmagnetismus. Nos. 1, 2.

BELGIUM.

Brussels.—*Académie Royal des Sciences des lettres, et des Beaux Arts. Nos. 1, 2.

Liege.—Société des Sciences. No. 1.
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GREAT BRITAIN AND THE COLONIES.

England.

Cambridge.—The Philosophical Society. Nos. 1, 3.
,, The Public (Town) Library. Nos. 1, 2, 3.
,, The Union Society. Nos. 1, 3.
,, The University Library. Nos. 1, 2, 3.

Dudley.—Dudley and Midland Geological and Scientific Society. Nos. 1, 2.

Leeds.—*Philosophical Society. Nos. 1, 3.
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Liverpool.—*Literary and Philosophical Society. Nos. 1, 2, 3.

London.—Editor, *Cassell's Encyclopædia.* Nos. 1, 2, 3.
,, Editor, *English Encyclopædia.* Nos. 1, 2, 3.
,, Editor, *Popular Science Review.* Nos. 1, 2, 3.
,, *Quekett Microscopical Club. Nos. 1, 3.
,, *The Admiralty Library. Nos. 1, 3.
,, The Agent-General (two copies). Nos. 1, 2.
,, *The Anthropological Institute of Great Britain and Ireland. Nos. 1, 3.
,, The British Association. Nos. 1, 3.
,, The British Museum (two copies). Nos. 1, 2, 3.
,, The Chemical Society. Nos. 1, 3.
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,, The Museum of Practical Geology. No. 1.
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,, *The Linnean Society. Nos. 1, 3.
,, The London Institution. Nos. 1, 2, 3.
,, *The Meteorological Office. Nos. 1, 3.
,, *The Meteorological Society. Nos. 1, 3.
,, *The Physical Society, South Kensington Museum. Nos. 1, 3.
,, The Queen's Library, Windsor. Nos. 1, 2, 3.
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Manchester.—Literary and Philosophical Society. Nos. 1, 2, 3.
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,, *The Geological Society. No. 1.

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,, The Museum. Nos. 1, 3.
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Oxford.—*The Ashmolean Library. Nos. 1, 2, 3.
,, *The Bodleian Library. Nos. 1, 2, 3.
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Penzance.—Geological Society of Cornwall. Nos. 1, 3.

Plymouth.—*Devon and Cornwall Natural History Society. Nos. 1, 3.

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Wisbech.—**Messrs. Leach and Son.* Nos. 1, 3.

SCOTLAND.

Aberdeen.—The University. Nos. 1, 2, 3.

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,, *Geological Society. No. 1.

,, *Royal Physical Society. Nos. 1, 3.

,, *The Royal Society. Nos. 1, 2.

,, *The Royal Observatory. No. 1.

,, The University. Nos. 1, 2.

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IRELAND.

Dublin.—Geological Society, No. 1.

,, *Royal Irish Academy. Nos. 1, 2, 3.

CAPE OF GOOD HOPE.

Cape Town.—The Philosophical Society. Nos. 1, 2.

THE DOMINION OF CANADA.

Hamilton (Canada West)—Scientific Association. Nos. 1, 2.

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,, Natural History Society of Montreal. No. 1.

Ottawa.—Academy of Natural Sciences. No. 1.

Toronto.—*Canadian Institute. Nos. 1, 2.

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Calcutta.—*The Asiatic Society of Bengal. Nos. 1, 2, 3.

,, The Geological Museum. Nos. 1, 3.

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Port Louis.—The Royal Society of Arts and Sciences. Nos. 1, 2.

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,, Editor, *Sydney Morning Herald.* No. 1.

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,, Editor, *Evening News.* No. 1.

NEW ZEALAND.

Auckland.—*Auckland Institute. Nos. 1, 2.

Christchurch.—Philosophical Society of Canterbury. Nos. 1, 2.

Otago.—Otago Institute. Nos. 1, 2.

Wellington.—The Philosophical Society. Nos. 1, 2.
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,, *The South Australian Institute. Nos. 1, 2.
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,, *The Government Botanist. No. 1.
,, *Adelaide Philosophical Society (S. A. Institute). Nos. 1, 3.

TASMANIA.

Hobart Town.—*The Royal Society of Tasmania. Nos. 1, 2.

VICTORIA.

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,, *The Observatory. No. 1.
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Bordeaux.—Académie des Sciences. Nos. 1, 2.

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Lille.—*Société Geologique du Nord. No. 1.

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Paris.—Académie des Sciences de l'Institut. Nos. 1, 3.
,, *Cosmos.* Nos. 1, 2, 3.
,, *Depôt des Cartes et Plans de la Marine. Nos. 1, 2, 3.
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,, L'Observatoire. Nos. 1, 3.

Paris.—Muséum d'Histoire Naturelle. Nos. 1, 3.
,, Royal Académie des Sciences. Nos. 1, 2.
,, Société Botanique. Nos. 1, 3.
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,, Société d'Anatomie. Nos. 1, 3.
,, Société d'Anthropologie. Nos. 1, 3.
,, Société de Biologie. Nos. 1, 3.
,, Société de Chirurgie. Nos. 1, 3.
,, Société d'Encouragement pour l'Industrie Nationale. Nos. 1, 2, 3.
,, Société de Géographie. No. 1.
,, Société Entomologique. Nos. 1, 3.
,, *Société Géologique. No. 1.
,, Société Meteorologique de France. Nos. 1, 3.
,, Société Minéralogique. Nos. 1, 3.
,, *Société Philotechnique. Nos. 1, 2, 3.

Saint Etienne.—Société de l'Industrie Universale. Nos. 1, 3.

Toulouse.—Académie des Sciences. Nos. 1, 3.

GERMANY.

Berlin.—Chemische Gesellschaft. No. 1.
,, *Königliche Akademie der Wissenschaften. Nos. 1, 2.

Bonn.—Naturhistorischer Verein der Preussischen Rheinlande und Westphalens in Bonn. Nos. 1, 2.

Carlsruhe.—Naturwissenschaftlicher Verein zu Carlsruhe. No. 1.

Cassel.—Verein für Naturkunde. Nos. 1, 3.

Chemnitz.—*Naturwissenschaftliche Gesellschaft zu Chemnitz. Nos. 1, 3.

Dresden. — *Das Statistische Bureau des Ministeriums des Innern zu Dresden. Nos. 1, 2.
,, Die Africanische Gesellschaft. Nos. 1, 3.
,, *General-Direction der Königlichen Sammlungen für Kunst und Wissenschaft zu Dresden. Nos. 1, 3.
,, Königlich Geologisches Museum. Nos. 1, 3.

Frankfurt a/ M.—*Senckenbergische Naturforschende Gesellschaft in Frankfurt a/ Maine. No. 1.

Freiberg (Saxony).—*Die Berg Akademie zu Freiberg. Nos. 1, 2.
,, *Naturforschende Gesellschaft zu Freiberg. No. 1.

Goettingen. — *Königliche Gesellschaft der Wissenchaften in Göttingen. Nos. 1, 2.

Gorlitz.—*Naturforschende Gesellschaft in Görlitz. Nos. 1, 3.

Halle a/ S.—*Die Kaiserlich Leopoldinisch—Carolinisch Deutsche Akademie der Naturforscher zu Halle a/ S. No. 1.

Hamburg.—*Die Geographische Gesellschaft in Hamburg. Nos. 1, 3.
,, *Verein für Naturwissenschaftliche Unterhaltung in Hamburg. Nos. 1, 2.

Heidelberg.—*Naturhistorisch Medicinische Gesellschaft zu Heidelberg. Nos. 1, 3.

Jena.—*Medicinisch Naturwissenschaftliche Gesellschaft. Nos. 1, 3.

Koenigsberg.—*Die Physikalisch-ökonomische Gesellschaft. Nos. 1, 3.

Leipzig (Saxony).—University Library. Nos. 1, 2.

Metz.—*Verein für Erdkunde zu Metz. No. 1.

Marburg.—*Gesellschaft zur Beförderung der Gesammten Naturwissenschaften in Marburg. Nos. 1, 2, 3.
,, *The University. No. 1.

Mulhouse.—*Industrial Society. Nos. 1, 3.

Munchen.—*Königlich Akademie der Wissenschaften in München. Nos. 1, 2.

Stuttgart.—*Königlich Statistich-Topographisches Bureau zu Stuttgart. Nos. 1, 2, 3.

Wurttemberg.—*Der Verein für Vaterländische Naturkunde in Württemberg. Nos. 1, 2.

HUNGARY.

Bistritz (in Siebenbuergen).—Direction der Gewerbeschule. Nos. 1, 2, 3.

ITALY.

Bologna.—Academia delle Scienze dell' Instituto. Nos. 1, 2, 3, and back nos.
,, University. Nos. 1, 3.

Genoa.—Museo Civico di Storia Naturale. Nos. 1, 3.

Milan.—Reale Instituto Lombardo di Scienze Lettere ed Arti. Nos. 1, 3, and back nos.
,, Societá Italiana di Scienze Naturali. No. 1.

Modena.—*Académie Royale des Sciences Lettres et Arts de Modene. Nos. 1, 3.

Naples.—Societá Reale Accademia delle Scienze. Nos. 1, 2, 3.
,, Zoological Station (Dr. Dohrn). Nos. 1, 3.

Palermo.—Accademia Palermitana di Scienze Lettere ed Arti. Nos. 1, 3.
,, Reale Instituto Technico. Nos. 1, 3, and back nos.

Pisa.—*Societa Toscana di Scienza Naturale. Nos. 1, 2, 3.

Rome.—Accademia Pontificia dé 'Nuovi Lincei. Nos. 1, 3, and back nos.
,, Circolo Geographico d'Italia. Nos. 1, 3.
,, Osservatorio del Collegio Romano. Nos. 1, 3.
,, *R. Accademia die Lincei. Nos. 1, 2, 3.
,, *R. Comitato Geologico Italiano. No. 1.

Siena.—R. Accademia de Fisiocritici. Nos. 1, 3.

Turin.—Reale Accademia delle Scienza. Nos. 1, 3.
,, Regio Osservatorio della Regio Universita. Nos. 1, 3.

Venice.—Reale Istituto Veneto di Scienze Lettere ed Arti. Nos. 1, 2, 3.

JAPAN.

Yokohama.—*Asiatic Society. Nos. 1, 2.

NETHERLANDS.

Amsterdam.—*Academie Royale des Sciences. Nos. 1, 2, 3.

Haarlem.—*Société Hollandaise des Sciences. Nos. 1, 2, 3.
,, *La Bibliothèque du Musée Teyler. Nos. 1, 3.

NORWAY.

Christiania.—*Kongelige Norske Fredericks Universitet. Nos. 1, 2, 3.

RUSSIA.

Moscow.—La Société Imperiale des Naturalistes. Nos. 1, 2.

St. Petersburg.—L'Académie Imperiale des Sciences. Nos. 1, 2, 3.

SPAIN.

Madrid.—Instituto geografico y Estadistico. Nos. 1, 2, 3.

SWEDEN.

Stockholm.—*Kongliga Svenska Ventenskapo-Akademie. Nos. 1, 2, 3.
,, The University. Nos. 1, 3.

SWITZERLAND.

Geneva.—Institute National Genevoie. Nos. 1, 2, 3.

Lausanne.—*Société Vaudoise des Sciences Naturelles. Nos. 1, 2, 3.

Neuchatel.—*Société des Sciences Naturelles. Nos. 1, 2, 3.

Number of Publications sent to	Great Britain	163
,, ,, ,,	The Colonies (including India)	75
,, ,, ,,	America	56
,, ,, ,,	Europe	221
,, ,, ,,	Editors of Periodicals ...	7
,, ,, ,,	Asia (Japan)	1
	Total	523

A. LIVERSIDGE, } Hon. Secretaries.
A. LEIBIUS, }

The Society's House, Sydney, November 14th, 1879.

REPORTS FROM THE SECTIONS

(IN ABSTRACT.)

REPORTS FROM THE SECTIONS.

(IN ABSTRACT.)

SECTION A.—ASTRONOMY AND PHYSICS.

4 APRIL, 1879.

Mr. H. C. Russell, F.R.A.S., in the Chair.

The following officers were elected:—Chairman: Mr. H. C. Russell, F.R.A.S. Secretary: Mr. G. D. Hirst. Committee: Rev. G. Martin, Mr. W. J. MacDonnell, Mr. J. Brooks, Mr. H. G. A. Wright, M.R.C.S.

The Chairman exhibited a photograph of a driving-clock controlled by four pendulums attached to a chronograph at the Observatory.

2 MAY, 1879.

Mr. H. C. Russell, F.R.A.S., in the Chair.

The Chairman read some notes on a new method of printing star maps, and exhibited some proofs of drawings executed by his process.

6 JUNE, 1879.

This meeting lapsed for want of sufficient attendance.

4 JULY, 1879.

Mr. H. C. Russell, F.R.A.S., in the Chair.

A paper was read by Mr. John Tebbutt, F.R.A.S., Windsor, on the occultation of 64 Aquarii by Jupiter, on the 14th September, 1879.

The Chairman read a note on the recent conjunction of Mars and Saturn, on the morning of the 1st July, 1879.

1 AUGUST, 1879.

Mr. H. C. Russell, F.R.A.S., in the Chair.

It was resolved that an application should be made to the Council for the purchase of Schmidt's Map of the Moon, and "The Atmosphere," by C. Flammarion.

The Chairman read a paper on the River Darling and the water which should pass through it.

5 SEPTEMBER, 1879.

This meeting was postponed.

3 OCTOBER, 1879.

Mr. H. C. Russell, F.R.A.S., in the Chair.

Mr. G. D. Hirst exhibited a drawing, in coloured crayons, of Jupiter, taken on the evening of the 2nd September.

7 NOVEMBER, 1879.

Rev. Geo. Martin in the Chair.

Mr. H. C. Russell submitted a drawing of an arrangement for the suspension of a glass mirror in the silvering bath, by which the necessity for the use of pitch is obviated.

Mr. H. S. Hawkins read a paper on a compiled catalogue of stars.

It was resolved that Mr. Hawkins's paper be forwarded to the Council, in order that it may be read at a general meeting of the Society.

On a new method of printing Star Maps.

By H. C. Russell, B.A., F.R.A.S., Government Astronomer

[*Read before the Astronomical Section, 2 May*, 1879.]

I suppose every astronomer, and many other scientific men, have been at times hindered from publishing star maps and diagrams by the expense and trouble which attends the production of such things by the processes in common use. I, at least, have frequently had to forego publishing such things on account of the cost attending it, and I have recently been looking about me for some method of doing it at less cost, and, if possible, by my own hands, so that I might avoid the mistakes which occur when such maps have to be drawn or engraved by a person who does not understand them, and also from the uncertain contraction and expansion of paper in the several stages of the process.

I find a method of printing in common use which, by certain modifications, gives me all I require, and more than I expected to find. As this process will enable any person at a very trifling cost to print star maps or other like things, I thought a few words describing it might not be without interest to the members of the Astronomical Section. My remarks are not intended for printers, to whom all that is here stated may be familiar.

To make a block for printing a star map I proceed as follows:—Having determined the size the map is to be, I obtain a plate of type or electrotype metal, about a quarter of an inch larger each way than the map is to be—the two sides must be planed or turned quite true and parallel. One side is then carefully rubbed with a piece of *water-of-ayr stone* (the same as lithographers use) until all the tool-marks are removed and a nice uniform smooth surface is obtained.

Upon this surface two lines parallel to each side and about a quarter of an inch apart are drawn, and within the rectangle thus formed the reference lines are drawn. These lines should be fine and deep, and are best drawn by the corner of a tool in shape something like a very fine screw-driver. Such a tool, if carefully sharpened, and held nearly upright while it is drawn along the ruler, cuts a clean deep grove in the metal. The letters indicating the value of each reference line are then punched or engraved within the parallel lines at the sides, and the block is ready for the stars. These are simply holes in the metal, and are most easily made by punching them in either with a set of punches corresponding to the sizes of the holes required, or by having a conical punch and driving it in until the hole is of the required size. Having thus marked the positions of all the stars on the

block, the name, or any remarks to be printed with it, are engraved, and it is ready for the finishing process, which is rubbing it very lightly with *water-of-ayr stone* and water, to remove the burr raised at the edges of the lines and holes. Care must be taken not to make the surface uneven with the stone.

If the block is small, 4 or 5 inches each way, it may be printed in an ordinary letter-book press, and in that case the metal may be any convenient thickness; but if it is large it must be type-high—that is, as thick as the length of an ordinary type letter. If too much ink is used in the printing the lines fill up and will not print; if too little ink the prints will not be black. Similar defect may be caused by want of power in the press. I have obtained prints in this way as good as the best lithographic work.

Every observer knows that wonderful misty background which makes the milky-way so beautiful—star dust as it is called; but the points, if there be any, refuse to be separated with any telescopic power. Now in a star cluster, of which I have recently made a map, this star dust is a conspicuous feature; the more so because at one place it is not to be found, and there right by the side a most beautiful cluster is a Coal-sack as black as night, without a star to relieve its gloom. I am anxious, if possible, to show something like this star dust in the printed map, and I find it can be done by making very small holes all over the surface of the metal either with a number of needle points fastened together or by putting a piece of sand-paper on the metal and pressing it so that the sand dents the surface; or more simply by putting a piece of sand-paper at the back of the paper to be printed; this produces the desired effect, a very faint mottling, the points of which cannot be seen without close examination. The examples now exhibited will illustrate what is meant.

A modification of this method would print nebulæ white on a black ground.

So far I have only spoken of type metal, but other metals may be used, and I have found sheet-lead very easy to work, and quite hard enough to print a few hundred copies. The only difficulty is to get a smooth flat surface, as the lead is easily dented.

The foregoing method of making star maps has several important advantages:—First, the observer can himself make the printing block and print the maps; by so doing nearly all the cost of the ordinary star map is saved. The observer can be sure the stars are in the right places and of the proper relative magnitudes. The maps being printed on dry paper are subject to the minimum of distortion from expansion or contraction of the paper. And lastly, the block itself can be kept as a permanent record of the work, and any subsequent observations can be added, and the map again printed with additions.

Occultation of 64 Aquarii by Jupiter, Sep. 14th, 1879.

By JOHN TEBBUTT, F.R.A.S.

[*Read before the Astronomical Section, 4 July,* 1879.]

IN the astronomical column of *Nature* for December 19th, 1878, it is announced that in all probability the star 64 Aquarii of the 6½ magnitude will be occulted by the planet Jupiter on the 14th September next, but owing probably to the circumstance that the phenomenon will be invisible in Europe few particulars are given. In consequence of the extreme uncommonness of such a phenomenon, and the circumstance that it will be very favourable for observation in the Australian Colonies, I have thought it desirable to furnish observers with more details respecting it. For the calculation I have deduced the following apparent places of the planet, by means of second differences, from the ephemeris in the Nautical Almanac :—

d. h.		*h. m. s.*		° ′ ″
Sep. 14 1 Greenwich M. Time.	R.A.=	22 32 59·48.	N.P.D.=	100 39 4·5
„ „ 2 „ „ „	„	22 32 58·34.	„	100 39 11·2
„ „ 3 „ „ „	„	22 32 57·18.	„	100 39 18·0

The mean place of the star for the beginning of 1864, given in the Greenwich Catalogue for that year is R.A. = 22h. 32m. 6·50s., N.P.D. = 100° 44′ 4·7″. It depends on separate determinations with the transit circle on October 31st and November 4th of the same year which are very consistent Applying the annual variations of the Catalogue, which combine both precession and proper motion, I get for the mean place of the star for 1879·0 :—R.A. = 22h. 32m. 54·02s., N.P.D. = 100° 39′ 25·4″, and employing the independent quantities of the Nautical Almanac, the apparent place of the star for the date of the occultation becomes R.A. = 22h. 32m. 58·56s., N.P.D. = 100° 39′ 0·7″. As the equatorial horizontal parallax of the planet will be only 2·2″, and the planet itself will cross the meridian at Sydney during the occultation at an altitude of 67 degrees, it will be quite unnecessary, for the mere purposes of prediction, to consider the effect of parallax on the phases of the occultation. The effect will indeed be very much less than that which will probably be due to errors in the theoretical places of the planet. I have also thought it inexpedient to take into consideration the elliptic form of the planet's disc. Adopting 23·9″, therefore, as the mean of the equatorial and polar semi-diameters

of the planet, and also the other data before stated, I obtain the following for the geocentric phases of the occultation in Sydney mean time :—

		d.	h.	m.
Disappearance of star at planet's limb	Sep.	14	10	28
Least distance of centres (8·5")	,,	,,	11	42
Conjunction of planet and star in right ascension...	,,	,,	11	53
Reappearance of star at planet's limb	,,	,,	12	55

It is thus seen that the star will be concealed by the planet's disc for the space of two hours and twenty-seven minutes. The disappearance occurs at 91° from the northernmost point of the limb towards the west, and the reappearance at 48° from the same point towards the east, for the *direct* image. The positions of these points for the *inverted* image will of course be diametrically opposite. I trust our astronomers will not allow the opportunity to pass unimproved for witnessing so rare a phenomenon as the occultation of a fixed star of the 6½ magnitude by a planet, and for testing the accuracy of Leverrier's new tables from which the ephemeris of Jupiter in the Nautical Almanac is now computed.

Note on the Conjunction of Mars and Saturn, July 1st, 1879.

By H. C. Russell, B.A., F.R.A.S., Government Astronomer.

[*Read before the Astronomical Section, 4 July,* 1879.]

The morning proved very unfavourable for observations of this interesting conjunction, heavy rain-clouds were passing over almost constantly, and it was only between the breaks in the clouds that the planets could be seen at all. At 4 a.m. there came a promising break and the sky was nearly clear, but in a few minutes it was clouded over again.

The clouds were so thick frequently as to hide both the planets, but Mars was often visible when Saturn was out of sight. The clouds thus afforded an admirable test of the relative brilliance of the planets. By dint of steady watching a number of views of the planets were obtained when the sky was free from clouds, but there was always more or less haze. At every observation the colour of Mars was noted clear reddish, and Saturn greenish yellow and the surface quite dull compared with Mars. The shade of colour was that of the solar spectrum, midway between D and E, but entirely without brilliance, in fact very dull-looking.

I remarked that Mars seemed clear and brilliant, as if it had lost the hazy coating which was so troublesome at the last opposition; the dark markings even with a low power presented a contrast with other parts of the surface, that promised good definition had the earth's atmosphere been clear.

The colour seen upon Saturn was not the polar colouring so often seen under favourable circumstances, but a tint over the whole planet, and it was the more remarkable to me because, when viewed with the naked eye, Saturn has always seemed to me to be the same colour as Antares.

I was unable to get any micrometer measures of the difference in declination between the limbs of the planets until 6h. 16m. 13s. S.M.T., when the difference measured 92″·23; nine other measures were obtained between that time and 6h. 39m. 30s., when the difference measured 103″·03. Computing from all the measures obtained, I find that at the time of conjunction in right ascension the difference between the limbs of the planets was 81″·83, and the distance between their centres 95″·03, and that the least distance of limbs was 78″·40 and of centres 91″·60; these are all apparent distances.

It is perhaps worth while here to record a few of the estimates of the colour of Saturn when observed under favourable conditions.

R.A.S. notices, June 8, 1832. Mr. Lawson observed an occultation of Saturn by the moon on May 8th, 1832, with a 5ft.

Dolland telescope, power 150. He remarked :—"At emersion the planet appeared small, dull and gauzy; at three or four diameters' distance from the moon it appeared as usual as to size, but the colour was a *yellowish green*, somewhat like that of dull or what is technically called 'mat' gold."

Mr. Holehause, same date, observing with a 7-ft. achromatic power 100, says at emersion—"The planet was of a leaden hue."

R.A.S. notices, May 13, 1859, page 240. At an occultation of Saturn by the moon on May 8th, 1859, Mr. T. W. Burr observes—"The dull *leaden blue* colour of the planet at the emersion was very striking"; telescope 3¾, power 173. At the same occultation Mr. W. Simms, who observed with a 4-in. telescope, power 200, says—"The dark limb of the moon passed steadily over the planet, without the slightest distortion appearing in either body."

Mr. J. W. Jeans, same date, says—"Upon emersion the colour of the planet was *very ashy*, but I believe entirely from contrast."

Rev. W. R. Dawes, same date, observing with 7¼-inch telescope, power 235, says—"The very *pale greenish hue of Saturn* contrasted strikingly with the brilliant yellowish light of the moon."

Captain Noble, same date, with telescope 4·2, power 255, says—"Owing to the effect of contrast, Saturn appeared of a *faint greenish grey*, or *greyish green colour* (such as might be produced by mixing yellow ochre and bistre with a great deal of water)."

Mr. W. R. Grove, same date, 4·3-inch telescope, power 165, says—"On emergence the extremely faint light of Saturn contrasted with the moon was very remarkable; Saturn was a mere ghost of himself, a *faint grey blue colour.*"

Mr. Lassell, same date, with 22-inch telescope, power 316, says—"The colour of Saturn on emerging was certainly pale and of a *greenish hue*, in comparison with the moon's lustre and colour, but it was not so pale and dull as I expected."

Occultation of Saturn by the moon, April 19th. 1870. Captain Noble, telescope 4·2, power 255, says—"Saturn appeared of a richly *greenish yellow* when compared with the brilliant light of the moon."

Supplementary number R.A.S. notices, vol. 31, page 262. Rev. J. Spear says—"On June 13th, 1870, observed occultation of Saturn by the moon. The planet when near the moon's limb assumed a *sickly green hue*"; (telescope 4¼ inches).

At the occultation of Saturn, May 8, 1859, the planet made ingress at the *dark* limb of the moon. Most of the observers mention having seen this very distinctly, but it is remarkable that not one of them says anything about the green colour of Saturn before ingress; it would seem to have been remarked when Saturn was several times its own diameter from the edge of the moon.

The River Darling—the water which should pass through it.

By H. C. Russell, B.A., F.R.A.S., Government Astronomer.

[*Read before the Astronomical Section*, 1 *August*, 1879.]

Some considerations respecting the rainfall upon the basin of the river Darling led me to make a few figures in order to test an opinion I had formed some time since, to the effect that but a small part of the rainfall, after making every allowance, passes down the river. I was not however prepared for the result which I obtained, and as it throws some light upon our river system, I thought it would be interesting to the members of Section A.

The basin of the Darling is considerably more than 200,000 square miles, but for my present purpose I have assumed that it is only 200,000 square miles. A great part of this consists of the western slopes of the Great Dividing Range, extending from Orange northwards into Queensland, and upon this part of it the rainfall in an average year ranges from 20 to 40 inches; in the more western districts drained by the Darling the average is from 10 to 20 inches. I have taken 16 inches as the average fall all over it, and this is beyond question under the true amount. Now, upon the best part of the drainage, *i.e.*, the western slopes, it may safely be assumed that ⅓ of the rainfall, averaging there about 30 inches, gets into the rivers; upon the flatter portions this proportion would be less, but in order to make allowance for this, and for the effects of evaporation and be quite within the quantity of water which must run off the land, I have assumed that only part of the rainfall reaches the river.

At Bourke the Darling is said to be 60 yards wide. I have assumed it to be 200 feet, and that instead of the contraction in its channel below the water surface, it has a rectangular section. Its velocity when in flood, 32 feet above summer level, has been carefully measured and was only two-thirds of a mile per hour, though it has been said that in contracted parts of the river lower down it sometimes flows 1½ mile per hour. I believe the smaller measured velocity to be the more correct, but in order here again to make full allowance I have assumed the velocity to be one mile per hour. And I find that after making these allowances, in which you will observe that I have assumed the current to be more rapid and the river considerably more capacious than it really is, while at the same time I have taken the available rainfall at only 2 inches, I find that in order to carry off this small rainfall the river would have to be 100 feet deep; that is, that it would, in order to carry off the rainfall, have to flow as a

solid stream of water 100 feet deep and 200 feet wide, at the rate of 1 mile per hour, without any cessation throughout the year. Now, we all know that the Darling not only does not flow in such volume even in the wettest season, but that in a year of average rainfall, such as I have assumed, it is not navigable for more than about six months, and even then does not carry one-third of the water shown above, and that in summer it is very low, and perhaps stops running. What then becomes of the rain-water? A large part of it must do, as it is known the waters of the Barcoo and other rivers do, viz., sink into the ground, to flow at some lower level.

These considerations point to an inexhaustible supply of water from wells, and we cannot be surprised that so many wells have been made and found to confirm the ideas here presented, and there can be no doubt that beneath the surface of our flat country there is an unlimited supply of good water.

It may be objected to the foregoing statement that one-half of the Darling watershed is so flat that very little, if any, water runs to the rivers, and therefore it is not fair to include it in the estimate. But even if this were true, and I do not think it can be proven, yet it must be admitted that it is over this flat country that so little rain falls; and if the drainage be confined, for the sake of argument, to the western slopes, where the land has a considerable fall, it will be necessary also to take the rainfall of this district, which is at least double of that assumed for the whole basin, and the area of these western slopes amounts to fully 100,000 square miles, so that the water estimated would come to the same. It should be remembered that the rainfall I have used is not that of what may be called a wet year, but simply an average year. What then must be the quantity of water in a wet season which finds its way underground to some outlet?

SECTION B.—CHEMISTRY AND MINERALOGY, and by amalgamation with Section C, GEOLOGY AND PALÆONTOLOGY.

14 MAY, 1879.

The following gentlemen were elected to serve on the Committee for the ensuing year:—Mr. Dixon, F.C.S., Chairman; Mr. M'Cutcheon, Honorary Secretary; Messrs. R. Hunt, F.G.S., Harrie Wood, C. S. Wilkinson, F.G.S., and S. L. Bensusan.

Mr. Bensusan presented several mineralogical specimens, gold and silver bearing ores, and a sample of metallic copper finely disseminated through serpentine, from New Zealand.

Mr. Sleep presented some fine copper ores from Cloncurry, Queensland, for the Society's cabinet.

11 JUNE, 1879.

Mr. Dixon, F.C.S., in the Chair.

Mr. Gipps exhibited some specimens of fossils from the Cape Hawk Barrier Reef.

It was resolved that Mr. Wilkinson be requested to act as Curator for the Society's cabinet connected with this Section.

9 JULY, 1879.

Mr. Dixon, F.C.S., in the Chair.

A letter from Mr. Wilkinson, consenting to act as Curator, was read.

Professor Liversidge, on his return from Europe, exhibited some improved forms of Bunsen and other gas-burners, examples of nickel-plated chemical apparatus, specimens of metallic potassium and sodium, and a series of beautiful crystals of some of the rarer salts.

13 AUGUST, 1879.

Mr. Dixon, F.C.S., in the Chair.

A specimen of blende containing gold at the rate of 54 ozs. per ton, and of Kupfernickel in serpentine, was exhibited by Mr. Dixon.

Professor Liversidge exhibited some further interesting novelties in chemical apparatus, including sets of gramme weights in rock crystal, from the kilogramme downwards; and copies of the plan and elevations of the laboratory at Owen's College, Manchester, together with working drawings of some of the fittings.

The remaining meetings for the year lapsed.

SECTION D.—BOTANY.

No report.

SECTION E.—MICROSCOPICAL SCIENCE.

MONDAY, 7 APRIL, 1879.

THE preliminary meeting for the session. The Rev. G. Martin was voted in the Chair.

The minutes of the previous meeting were read and confirmed.

A ballot was taken for the election of officers for the current session, with the following result:—Chairman: Rev. G. MARTIN. Secretary: Mr. P. R. PEDLEY. Committee: Dr. MORRIS, Messrs. H. G. A. WRIGHT, G. D. HIRST, and W. MACDONNELL.

It was decided to hold the meetings, as in the past session, on the evenings of the second Monday in each month.

MONDAY, 13 MAY, 1879.

The Rev. G. MARTIN in the Chair.

Mr. H. SHARP presented to the Society's cabinet six slides, as follows:—Trans. sect. tongue of native cat, trans. sect. intestine of magpie, section of kidney (from a child two months old), section of nose of Australian native cat, trans. section of medicinal leech, and a slide of various insect scales.

Mr. H. SHARP exhibited a self-centering turn-table, furnished with a wheel and pinion gearing of his own construction.

Mr. W. MACDONNELL exhibited a preparation of the medicinal leech, showing teeth, &c.; Mr. G. D. HIRST, larva of *Myrmeleon*; Mr. MARTIN, *Tetraspores* of marine *Algæ*; and Mr. PEDLEY, a transverse section of the tongue of *Cyclodus gigas*, stained with carmine.

MONDAY, 9 JUNE, 1879.

The Rev. G. MARTIN in the Chair.

Mr. H. A. GILLIAT presented five slides, as follows:—*Climascophenia Australis*, from South Reef; *Polyzoa*, Port Jackson; *Chælomium chartarum*; scales of *Lepisma saccharina*; and spicules of *Tethya* (sponge).

Mr. W. MACDONNELL called the attention of the meeting to a new mineral oil for illuminating purposes, which had been manufactured under his immediate supervision, and styled "Euphaneron." This oil burns with a singularly white and brilliant light, and was much admired.

Mr. G. D. HIRST read "Some Notes upon some Objectives recently manufactured by Carl Zeiss of Jena." At the conclusion of his paper Mr. Hirst practically illustrated the resolving

powers of the objectives referred to, viz., an oil immersion $\frac{1}{8}$th, and a water immersion G of a new construction, on some difficult diatom test objects.

Mr. FRY exhibited sections of fungi, and Mr. MARTIN sections of limestone.

MONDAY, 14 JULY, 1879.

The Rev. G. MARTIN in the Chair.

Mr. G. D. HIRST read an extract from a letter received from Mr. H. Sharp, commenting on the excellent performances of a $\frac{1}{10}$th immersion objective just received from Mr. Tolles of Boston. Mr. Hirst exhibited a piece of accessory apparatus in the form of a mechanical finger, which he had made and adapted to his instrument.

Dr. MORRIS exhibited some slides of local *Diatomaceæ*, viz., a variety of *Actinocyclus* and *Coscinodiscus radiatus*.

Mr. H. O. WALKER exhibited the palate of a slug, and some mosquito larvæ, and Mr. PEDLEY a series of slides representing the *Cyclostomatous polyzoa* of Port Jackson.

MONDAY, 11 AUGUST, 1879.

Mr. H. G. A. WRIGHT, M.R.C.S., in the Chair.

Mr. G. D. HIRST read a note on *Eozoon canadense*, the gigantic foraminifer of the Laurentian limestone rocks, and exhibited drawing of sections of the same.

Mr. PEDLEY read a paper by Mr. H. Sharp "On a comparative trial of Tolles's $\frac{1}{10}$th objective, with one of Zeiss's $\frac{1}{8}$th oil immersion objectives."

Mr. W. MACDONNELL exhibited slides of scales and feathers.

MONDAY, 8 SEPTEMBER, 1879.

The Rev. G. MARTIN in the Chair.

Dr. Morris exhibited preparations of carsin and creatine, under the polariscope. Mr. DE LISSA exhibited several slides of plant hairs.

MONDAY, 13 OCTOBER, 1879.

The Rev. G. MARTIN in the Chair.

Mr. G. D. HIRST exhibited a new and very effective tadpole trough.

Mr. R. B. READ exhibited the proboscis of *Macrosilia cluentius*.

Dr. MORRIS called the attention of the meeting to a hemispherical lens for immersion sub-stage illumination.

Mr. PEDLEY exhibited specimens of double-stained preparations, and described the process.

Mr. T. E. Hewett exhibited a series of beautifully prepared slides of parasites, &c.

Mr. Hirst (for Mr. Gilliat) exhibited a large and valuable collection of Polyzoa, from Port Jackson (50 slides).

Dr. Morris and Mr. Sharp undertook a comparative trial, to ascertain the relative advantages of illumination by means of Wenham's Reflex Illuminator, or Abbé's Hemispherical Immersion Illuminator, for the resolution of difficult test objects, from which it appeared that the Reflex Illuminator yielded a rather better result, but that Professor Abbé's hemispherical lens was much easier of manipulation.

MONDAY, 17 NOVEMBER, 1879.

Mr. H. G. A. Wright, M.R.C.S., in the Chair.

Dr. Morris called the attention of the meeting to a solution of chloride of cadmium in glycerine, in the proportion of 25 per cent. as a substitute for the oil of cedar used with Zeiss's oil immersion lenses. This compound, when used for the immersion of the objective and the attachment of a small hemispherical lens in the place of an achromatic condenser in Dr. Morris's hands yielded the most gratifying results on a slide of a very small and closely striated species of *N. rhomboides*, which could not be satisfactorily resolved with the cedar oil. For the chloride of cadmium and glycerine, Dr. Morris also claimed that it improves the performance of ordinary immersion objectives when substituted for distilled water, and that, unlike the oil of cedar, the slides require no special preparation, as the fluid does not act upon any of the varnishes or cements ordinarily used in mounting.

Mr. T. E. Hewett exhibited and described a new form of dissecting microscope of his own construction. This instrument, which was much admired, is of an exceedingly steady form, and is fitted with a concentric rotating stage; the lenses, which are an adaptation of the plano-convex doublet of Sir John Herschel, give a large field and satisfactory definition.

Notes on some recent Objectives manufactured by Carl Jeiss, of Jena.

By G. D. Hirst.

[*Read before the Microscopical Section*, 9 *June*, 1879.]

It is likely that there are few present who are not acquainted with Zeiss's objectives; they have frequently been exhibited at our meetings, when their fine definition and great resolving power on different tests has been much admired. Several of us have specimens from ½in. and higher in our possession, and have proved how eminently fitted are they, no less for the general requirements of the microscopist than for work on obstinate diatoms.

It is not, therefore, to enlarge upon the general excellence of Zeiss's work that I have ventured to ask your attention for a moment to-night; but rather to bring under your notice the result of a trial of two of his very latest and choicest productions.

Through the kindness of Mr. F. B. Kyngdon I have had the pleasure of examining one of Zeiss's latest G immersions, and also one of his now celebrated oil immersion ⅛ths. The latter objective is probably the first of its kind that has been sent to this Colony.

The application of oil as a medium between the objective and the cover was suggested by Mr. J. W. Stephenson to Professor Abbe, who computed the necessary formula, in the practical application of which Mr. Zeiss has been most successful.

You who are already acquainted with the subject will pardon me if, for the benefit of those who might not be familiar with this new optical wonder, I state, in as few words as possible, the principle on which the introduction of oil as an immersion fluid is applied.

In the use of high powers there is nothing that requires more patience and practice than the application of the collar adjustment; even on a slide the cover of which is of known thickness and on an object with which we are thoroughly acquainted, we have great difficulty in making the adjustment perfectly, and having once got it to our satisfaction if we throw the objective again out of adjustment we shall seldom bring it back to the identical number on the scale on making the correction again without referring to the collar. If this be the case with a known object, how much more is the difficulty increased when we are working on an object with which we are totally unacquainted. Considerations such as these impressed Mr. Stephenson with the great desirability of constructing an objective in the use of which cover correction could be entirely dispensed with.

The origin of the correction for varying thicknesses of glass covers must be credited to the late Andrew Ross, who showed the imperative necessity of compensating the error arising from the difference between the front of the lens and the thin cover whenever high powers were used. Now if we can suppose a fluid having the same refractive and dispersive indices as the glass of which the front lens of the objective and cover is composed, the end in view will be attained.

A suitable medium for the purpose was by no means readily found; it was not until no less than sixty-three different oils and thirty other fluids had been tested that it was ascertained that oil of cedar-wood, though not absolutely identical with crown glass, was sufficiently so for the purpose, giving perfect results with oblique light. With central illumination, however, it was improved by the addition of one-fourth of oil of fennel seed.

The new oil immersion objective was first made of $\frac{1}{8}$in. focus, Zeiss has since produced a $\frac{1}{12}$in. on the same principle, but I have not heard of the latter being superior in any way to the former.

As far as externals go there is nothing in the appearance of the new objective to especially recommend it; the brass-work is well finished, but the absence of the screw collar, to which we are accustomed in the higher powers, gives it a rather common appearance. The diameter of the lenses, with the exception of that of the posterior combination, is larger than those of an ordinary lens of the same focus. Professor H. L. Smith, of America, though he did not take the trouble to take the lens to pieces, speaks of it in an article in the *American Journal of Microscopy* as a three-system objective, and states that the front lens is apparently too large for any four-system of equal focus; but on examining it I find it, as stated by the maker, to consist of four systems. The curves of the interior combinations appear to be entirely different to any of the ordinary $\frac{1}{8}$ths that I have taken to pieces. The lower surface of the third system from the front is an exceedingly deep concave; the corresponding surface on the water immersion G is slightly convex.

The angle is extreme—113° balsam, or larger in the proportion of 5 to 4 than a dry objective of 180° air angle, which, as Mr. Stephenson observes, renders it extremely sensitive to focusing, and also indicates the highest resolving power hitherto attained. It has a very large working distance, that between the front lens and object being 0·02, or $\frac{1}{50}$in.

And now as to its performance. Undoubtedly the first advantage that commends itself is the absence of any necessity for cover adjustment—you have merely to focus down the objective, arrange your light, and the best result is at once before you; but alas! with the departure of one trouble comes the advent of

another. The essential oil of cedar-wood is as thin as alcohol, and runs most vilely. It is, unfortunately too, a solvent of most of the cements usually employed in fixing the covers of dry mounts, Brunswick black and asphalt being readily dissolved by it. To protect our slides, therefore, we must re-ring them with shell-lac varnish or gold-size. The use of the oil, too, will always be a serious drawback in general work on objects under the compressorium, or temporarily mounted on a slip with the cover placed loosely over them. It would be difficult or almost impossible to change the oil lens for a water or dry one without disturbing the object under examination, and in the case of temporary mounts, the oil would be sure to run in under the cover and spoil the object.

To obtain the best results from this objective, as is evident from the principle of its construction, the objects examined should be either mounted in balsam or intimately attached to the cover. Objects mounted dry on the slide are but little better exhibited than by any ordinary immersion objective of wide angle. I have a pretty difficult slide of *N. Crassinerva*, to show the transverse lines on which, taxes any water-immersion objective I have employed to the utmost. Many of the valves had hitherto resisted all attempts at resolution; some of them are attached to the cover, others to the slide. Every one of the former yielded at once to the new $\frac{1}{8}$th, being resolved beautifully from end to end; the resolution was certainly the clearest and most crisp of any I have yet seen of this difficult diatom. The illumination was from a high angle, achromatic condenser by Crouch, of 165°. The lens worked well under A, B, and C eye-pieces, showing scarcely any softening under the last; it breaks down however under Ross's F eye-piece, as lines that are clearly seen with the C become obliterated under this very deep ocular. The G immersion $\frac{1}{8}$th is the only objective I have seen that will at all stand this very severe test, for though by the application of the F eye-piece the outline of the object is softened, yet any lines visible under a lower ocular are never obliterated.

I have a slide of *N. sigma*, belonging to Mr. Sharp, of Adelong, which that gentleman, who is experienced in the resolution of diatom tests, informed me he considered to be more difficult than *A. pellucida*, as, with the exception of one abnormally coarse valve on the slide, he had failed to resolve it at all, using for the purpose Zeiss's water $\frac{1}{8}$in. and $\frac{1}{12}$in. and Powell and Lealand's new formula $\frac{1}{8}$in., these objectives having, in his hands, resolved the *pellucida*. I succeeded in sharply resolving with the oil lens any valve on this slide with so little trouble that I anticipated an easy job with *pellucida*. I prepared a slide for the purpose by taking to pieces a dry mount of that diatom, and mounting it in

balsam between two thin covers so that the full angle of the condenser could be employed. I have however failed to resolve this test, either mounted as stated or dry. It probably requires the extremely oblique illumination of the reflex illuminator to successfully resolve it.

On *Podura* the performance of the lens calls for no especial remark. The definition of the exclamation marks is fine, but no better than the water immersions. There is a good deal of colour on this test of a reddish tint, similar to that shown by Zeiss's old G's. The field is very flat; in this respect the lens surpasses any I have yet seen of the same focus.

From the trials I have made of this objective I am convinced of its immense power on close-lined objects, and this, of course, means a power of grasping rays of an extreme angle. As it possesses this capacity, combined with so great a working distance, I cannot but think that, where the use of the oil does not present an insuperable barrier, the objective will render most excellent service. On mineral sections, for instance, the oil would be a positive advantage, obviating the necessity for the extreme polish required when using other lenses, as the nature of the medium prevents the breaking up and diffusion of light by rough surfaces

I would add a word in reference to one of Zeiss's latest water-immersion (G) $\frac{1}{8}$ths received with the oil lens. My own G by this maker was made about three years ago, and the present objective is one of his best and latest of that class. Zeiss has certainly lately improved the finish of his brass-work; in this respect there is nothing now left to be desired. He also now makes the nose-piece of the objective of German silver or some white metal, which vastly improves its appearance, and is besides better when working with fluids, as the lacquer on the brass suffers in time. The new immersion G has the same water angle as my own—viz., 108°—but the scale for cover correction is different; mine ranges from 7 to 17 divisions on the collar, which is equal to adjusting for covers from ·003 to ·007. The new G ranges from 10 to 23 divisions on the collar, equal to covers from ·004 to ·009. The adjustment for the increased thickness is undoubtedly an advantage; but it is a pity Zeiss did not give the new lens a range back to ·003, as many bought slides of tests have covers of that thickness. In resolving power there is nothing to choose between the new G and my own; they are both fine glasses in this respect, and will show every possible test that their aperture is capable of. I made many trials of both on *N. Crassinerva*, and any lines visible in the one could be seen by the other. On the *Podura* scale the new lens was the most achromatic—the markings were quite black; in my own they are slightly red. Zeiss appears to have succeeded with his new water $\frac{1}{8}$in.

in eliminating the colour shown by his older objectives without impairing their marvellous definition. They are wonderful objectives, especially when their cost is considered, which is less than one half of what Powell and Lealand charge for their new formula $\frac{1}{8}$th, and to which they are equal in every respect, except a slight inferiority in resolving power, and even that only becomes apparent on a test of extreme delicacy such as *A. pellucida;* indeed I see no reason why Zeiss should not be able to extend the angle of his water lenses to a degree or two more without materially increasing their cost, and they would then in every respect equal their far-famed London rival.

Notes upon Tolles's duplex front one-tenth immersion objective, and of a comparative trial of the same with Zeiss's oil immersion one-eighth (No. 18), by both oblique and central light.

By H. Sharp.

[*Read before the Microscopical Section*, 11 *August*, 1879.]

Having a few weeks ago received from Mr. Tolles, of Boston, a $\frac{1}{10}$th objective on his most recent formula and construction, it has occurred to me that a detailed account of the performance of this justly celebrated lens may be acceptable to those microscopists who are interested in the improvement of the highest class of objectives by our best makers.

This objective was made to my special order, occupied one month in construction, and was completed on 5th of May last; it has an air angle of 180° and a balsam angle of 100°, and works either dry, immersion with water, or immersion with glycerine, without change of front, the corrections for the different fluids being most perfectly accomplished by the use of the screw collar. It is a duplex front or four system objective, and the screw collar has an unusual range of position, and the magnifying power varies considerably according to the position of the collar; when set for *dry uncovered*, *i.e.*, with the lenses at their furthest separation, the power (on Crouch's stand) with A eyepiece does not exceed 450 *diameters*, while when the combinations are closed, in which position the objective is adjusted for glycerine and cover 008″ to 009″, the power with A eyepiece is quite 540 *diameters*; with water immersion and covers from 004″ to 008″ the power is 470 *to* 500 *diameters*.

Used *dry* the performance of this glass in clearness of definition is unsurpassed by that of any dry high power I have ever used; a Seibert's dry $\frac{1}{12}$th of medium angle 135° which I have gives a slightly flatter field and greater working distance. Compared with Powell and Lealand's new formula $\frac{1}{8}$th with their dry front, the Tolles has greater working distance, is more achromatic, gives superior definition, and in flatness of field is not inferior, although the Powell and Lealand has a separate front and the Tolles has not.

The Tolles (dry) will correct and work through a cover gauged 007″ provided the object is adherent to the cover, but has hardly any working distance for focusing into an object which has any thickness, with covers 004″ and 005″; there is good working distance if the object is not very thick or in a cell.

With water immersion, and with either oblique or central light, in resolving power, clearness and brilliancy of definition, and extraordinary *penetration*, this $\frac{1}{10}$th of Tolles is unequalled by any water immersion objective I have yet seen, not excepting Powell and Lealand's new formula $\frac{1}{8}$th and Zeiss's best water immersion objectives of wide angle ($\frac{1}{8}$, $\frac{1}{12}$, and $\frac{1}{18}$). Notwithstanding its extreme angle, and that its working distance is shorter than that of Zeiss's lenses of equal power, its penetrating power is astonishing, for while the actual focal plane is shown with the most intense and perfect definition, parts lying far below the focal plane can be well seen without change of focus. In flatness of field or marginal definition this glass is not any better than Zeiss's $\frac{1}{8}$th or Powell and Lealand's $\frac{1}{8}$th. In all wide-angled objectives which I have ever seen this appears to be their weakest point, and the one where there is most room for improvement, though perhaps improvement in this point is scarcely necessary, as these lenses are mostly employed upon very minute objects, or points of minute detail in larger ones, and the central portion of the field is that which receives the close scrutiny of the observer; and we shall probably never see high power lenses of 180° angle giving flatness of field equal to a perfectly corrected $\frac{1}{4}$ of 75° to 80°.

With glycerine immersion the Tolles $\frac{1}{10}$th performs best with extremely oblique light; with central and moderately oblique light the definition though good is not so crisp and brilliant as with water, but on balsamed objects with light of that extreme obliquity which can only be obtained by the use of immersion illuminators, the resolving power with glycerine is, to quote Mr. Tolles, stronger and goes a "notch or two" farther than with water.

With this glass, glycerine immersion, Wenham's reflex and lamplight, I can now easily resolve (into striæ) the most attenuated valves on a particularly hard slide of *a pellucida* in balsam given me by Mr. Hirst.

In point of external finish and mechanical perfection this objective certainly excels any I have ever seen of any maker, the movement of its screw collar is of that exquisite smoothness only found in the most perfect workmanship, and the objective must be considered a masterpiece of consummate optical knowledge and manipulative skill, and fully sustains the high reputation of its maker.

Through the kindness of Mr. F. B. Kyngdon, I had the pleasure last week of trying one of Zeiss's celebrated oil immersion $\frac{1}{8}$th objectives, its owner having sent it to me by post, to try against my Tolles' $\frac{1}{10}$th, and I spent two evenings in a most exhaustive trial of the two "optical giants," both with oblique and central light. As this oil immersion objective has been already shown to members of the Society at one of the Microscopic Section meetings, and its principle of construction ably explained, and its performance shown by Mr. Hirst, I will only mention that its air angle

(180°) is the same as the Tolles, but its balsam angle of 108° is in excess of the latter by 8°. I am by no means clear about the real meaning of "balsam angle," only that *cæteris paribus* greater balsam angle gives greater resolving power.

In the trial of these glasses I used the following tests for oblique light:—*P. angulatum S. gemma, P. fasciola and Nitzchia sigma,* mounted dry, and *Amphipleura pellucida* in balsam, illumination by an ach. condenser of 160° angle, Wenham's reflex in immersion contact with slide by means of glycerine, and the concave mirror only. I was quite prepared to find the oil lens a diatom-smasher, and fully expected it to beat the Tolles by oblique light, and I must admit that the German giant beats the American, if they were race horses I should say by about half a length. On *angulatum* with the deepest eye-piece at my command (a D) I could see no difference, both glasses behaving splendidly, and giving such brilliant definition under the D eyepiece that it seemed to me they could work comfortably up to 3,000 diameters.

S. gemma On this diatom the oil lens had decidedly the best of it, showing the object with a richness and beauty that I never saw before, the Tolles showed the beading wherever the Zeiss did, but the *style* of the latter was superior; this superb performance was only on valves closely adhering to the cover; on valves not so adhering, the oil lens had no advantage that I could detect; with concave mirror and bull's-eye, the substage being removed, both glasses beautifully resolved the beading on good valves of *S. gemma.*

P. fasciola was beautifully resolved by both lenses, resolved in the true sense of the word, the markings not being shown merely as squares or checks, but clearly as *beads.* I must, however, state that my slide of *fasciola* is rather an easy one; on this diatom the Zeiss had slightly the advantage.

Nitzchia Sigma, dry. This slide is by far the most difficult test object (to me) I possess, and until I got the Tolles $\frac{1}{10}$th resisted all my efforts. I tried P. and L.'s $\frac{1}{8}$th and Zeiss' $\frac{1}{8}$th, and Zeiss's $\frac{1}{8}$th, $\frac{1}{15}$th, and $\frac{1}{25}$ on it without seeing the ghost of a marking; with the Tolles I can see the striæ with certainty on about one-fourth of the valves on the slide; on these the oil lens shows the striæ more easily, and on some of the other valves shows weak washy-looking lines where the Tolles shows nothing. This diatom in balsam yields easy resolution with the reflex illuminator, but this accessory when used on *dry mounted* objects does not accomplish any more in my hands than a wide angle condenser, though on objects in balsam, when used with glycerine between it and the slide and with immersion lenses, it goes far beyond any other mode of illumination that I have tried.

On the above tests I used the Tolles with water immersion. I now put the slide of *pellucida* (in balsam) on the stage, and a

drop of glycerine on the point of the objective, and removing the achromatic condenser slipped the reflex into its place, and in a couple of minutes had a valve of *pellucida* striated distinctly almost from end to end, and then carefully hunted the slide all over, but not a valve or fragment of a valve could I find which could defy the Tolles; many of the valves were almost as colourless as water and the striæ appearing quite dark by contrast; no fanciful resolution of weak or spurious striation, but lines as clear and distinct that any person of average eyesight could at once see them quite hard and distinct with D eye-piece, the valves with A eye-piece having an almost iridescent appearance from the extreme closeness of the lines, which under 1,500 diameters *appear* to the eye about like the $\frac{1}{100}''$ lines of a stage micrometer.

On removing the Tolles and putting on the oil lens without change of illumination, the latter showed the striæ wherever the $\frac{1}{10}$th did, but though I changed the glasses several times I could not say decidedly that one was better than the other; both objectives happened to *centre* exactly alike, an object left in centre of field of one appearing exactly in centre with the other. I could only have decided with certainty which glass was the best on this diatom by means of very deep eye piecing; I left off, however, with an impression that I could see striæ with the Zeiss a little nearer to the extreme ends of the valves than with the Tolles. On the whole, therefore, the German glass with oblique light exhibits a resolving power on diatomaceous tests somewhat greater than the American, and for any one making a special study of the ultimate structure of the siliceous valves of diatoms, an objective on the oil immersion principle would be the best instrument at present procurable in the world.

With central light the performance of the oil lens though good is quite eclipsed by that of the Boston objective, the definition and brilliancy of the latter being very superior; in point of flatness of field and marginal definition they are about equal.

On *podura* scale the oil lens showed rather more colour than the $\frac{1}{10}$th and the markings were not so crisp and sharply defined, and the same superiority on the part of the $\frac{1}{10}$th was observable on other insect scales and also on organisms in water. For obtaining perfectly central light I used the ach. condenser with the smallest aperture of the diaphragm behind its lenses, and a thin brass cap with a central aperture of $\frac{1}{30}$th diameters over the lenses. On *P. formosum* with condenser as above the Tolles glass gave the best view, though the difference in the two glasses was much less apparent than on the insect scales. On *angulatum* I obtained resolution with both objectives in a style I never saw before, viz., into distinct and brilliant *beads*, not merely dots, cross hatchings, or hexagonal spaces, but real genuine beading, like that which is so easily obtained on *P. formosum*. This resolution which I

first got with the Tolles objective I obtain by the use of the ach. condenser with smallest aperture of diaphragm and perforated cap accurately centred, but instead of having the image of the lamp flame exactly in the optical axis I incline the mirror so as to illuminate one side of the field more than the other (the light being then very slightly oblique); with this illumination a good well marked *angulatum* is shown as above described, the beads looking like minute hemispherical rubies; the oil lens does the same if possible even better than the Tolles, the slight obliquity of the light suiting the oil lens better than when perfectly central, but my Zeiss water immersion $\frac{1}{8}$th and $\frac{1}{10}$th with same illumination only show the markings as black or brown dots, which appear almost flat like ink dots on paper, the $\frac{1}{10}$th and the oil lens showing them in unmistakeable relief. In working distance the oil lens has the best of the $\frac{1}{10}$th as it works when in focus at about twice the distance of the latter; this very ample working distance is however in the case of the oil lens rather a disadvantage, as it is more troublesome to keep the thin fluid in suspension between lens and cover than if the working distance were shorter. I found that ordinary gum arabic solution afforded perfect protection against the solvent action of the oil of cedar on the varnishes and cements used for fixing the covers of objects. One advantage the oil lens possesses over all other high power lenses, is in not requiring any correction for varying thickness of cover—this saves the observer a great deal of trouble. The Tolles $\frac{1}{10}$th is very sensitive to its collar correction either dry or immersion, and has a very decided "best point" with any given cover.

Mr. Tolles has lately constructed a $\frac{1}{25}$th which works four ways with same front, viz., dry immersion with water, glycerine, or oil of cedar; and he varies his formulæ of construction to suit the specific wants of the purchaser of any objective. His objectives of 180° air angle he makes with balsam angles from 90° to 110°. In ordering mine I asked him to combine in as high a degree as possible resolving power with good central light performance, fair working distance and good performance when used dry, and I have every reason to be satisfied with the execution of the order.

I have written to Mr. Tolles for particulars concerning the construction, *modus operandi*, and price of his new immersion illuminator styled "Tolles's Semi-cylinder or Traverse Lens," which is stated to be superior to Wenham's Reflex for ultra oblique illumination, as it gives illumination at any angle of incidence and *measures the angle* at the same time up to nearly 90° with the optic axis of the microscope.

When I have obtained the information from Mr. Tolles I will acquaint the microscopists of our Society with the particulars; and I hope, at no very distant date, to be able to show this $\frac{1}{10}$th objective and its performance at one of our meetings.

An improved Dissecting Microscope.

By T. E. Hewett.

[*Read before the Microscopical Section*, 17 *November*, 1879.]

In designing the microscope now exhibited, I proposed to make it serve three purposes: (1) general use in mounting, (2) dissecting (3) the arranging of diatomaceæ in groups. I believe it will be found to fulfil these conditions in a very satisfactory manner.

Although light and not inelegant in appearance, the instrument weighs 3½ lbs., a by no means unimportant feature, since the greater part being in the base, it is less likely to be displaced from a fixed position when in use.

It is 4½ inches in height, the base is somewhat ovate, and measures 4¼ by 5¼ inches, and is fitted with concave mirror having the usual motions.

The standard carrying fixed stage screws into base, is cylindrical, and has fitted within it the rackwork, which is of sufficient length to focus a 4-inch objective.

Attached to rackwork is an arm having at one end an opening ⅞ inch in diameter, which is fitted with the power provided, and in which any objective may be conveniently placed.

The fixed stage is the same shape and size as base, and has a revolving plate (suggested by Mr. Pedley as a great aid in grouping diatoms). Attached underneath and centrally is a short piece of tubing into which slides another piece for carrying ground or blue glass diaphragms, &c.; this admits of revolving the stage without disturbing the illumination. I have found the simplest illuminator for artificial light to be a disc of pale blue glass known as Hogarth's blue, one side of which is ground with fine emery.

The clips for holding object-slide, together with handle for revolving stage, are easily detached, when there is a clear stage room of 4 inches diameter for use of dissecting trough.

Perhaps the most important feature is the power provided; it is known as the plano-convex doublet of Sir John Herschel, and consists of two plano-convex lenses of equal focus, the convex sides being in contact, and the eye and object opposite the plane sides. By this arrangement chromatic and spherical aberration is nearly destroyed, and a large and almost flat field is the consequence. I believe it has been seldom, if ever, applied to microscopes; my only knowledge of its practical use is at the Observatory, where Mr. Russell has used it for telescopic purposes. Upon making up one for that gentleman I was struck with its value for simple microscopes.

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The one exhibited is about equal to a single lens of $\frac{3}{4}$-inch focus, and is not very inferior to an achromatic objective, over which it possesses very decided advantages for our present purpose from the fact that its working distance and field are greater; it has an actual field of $\frac{1}{2}$-inch and a working distance of $\frac{5}{8}$-inch, and as diatoms as small as *Rhomboides* may be easily recognized, its use mounting is apparent.

I find that when one-third of the rays are shut out by a suitable diaphragm the definition is sharper, but as this limits the field I have preferred in this case to omit it.

SECTION G.—LITERATURE AND FINE ARTS.

THE first meeting of the session was held 2nd April, when Mr. E. L. MONTEFIORE was elected Chairman; Mr. PERCY E. WILLIAMS, Hon. Secretary; and Messrs. G. A. MORRELL, LUDOVICO W. HART, A. L. JACKSON, and E. DU FAUR, Members of Committee. The future meetings of the Section were fixed for the last Friday in each month.

FRIDAY, 30 MAY, 1879.

Mr. MONTEFIORE in the Chair.

The Chairman read a paper entitled "Art Criticism," and exhibited the journal of the explorer Sturt, kept during his last journey. A fine work on the hot springs of New Zealand, containing autotypes of that remarkable scenery, with letter-press by Dr. Hochstetter, was laid on the table by the Chairman.

Amongst other works of art exhibited was a pen and ink drawing by Mr. MONTEFIORE, from the picture by Gabriel Max, known as St. Veronica's pocket-handkerchief.

FRIDAY, 27 JUNE, 1879.

Mr. MONTEFIORE in the Chair.

The Chairman exhited a very rare edition of the *Fairie Queen*, "Disposed into XII Bookes Fashioning Twelve Morall Vertues," published in London, 1609.

Mr. L. W. HART read a paper on "The Black Forest," descriptive of the manners and dress of the peasantry and of the wonderful scenery of that country.

FRIDAY, 25 JULY, 1879.

Mr. MONTEFIORE in the Chair.

Several old engravings were laid on the table by the Chairman, including the "Jugement de Paris" by Vanderwerf, "Al Filosofo Menipo" of Velasquez, "Dido and Æneas," and a landscape by Woollett.

Mr. PERCY E. WILLIAMS called attention to a book published by Chatto and Windus, containing *facsimile* reproductions of some among the more noticeable of the artistic works of the late poet-artist William Blake.

Mr. WILLIAMS read an essay entitled "Eccentricities of the great Masters of the 14th and 15th Centuries," illustrating the domestic life, manners, and customs of the early fathers of art in Italy.

FRIDAY, 29 AUGUST, 1879.

Mr. MONTEFIORE in the Chair.

A valuable collection of original etchings by Edwin Landseer was laid on the table by Mr. MONTEFIORE, who read an exquisite little poem written in commemoration of that artist by J. Templeton Lucas.

The Chairman read the fine speech delivered by the Bishop of Peterborough, at the sixty-fourth anniversary of the Artists' Benevolent Institution.

FRIDAY, 25 SEPTEMBER, 1879.

No quorum.

FRIDAY, 31 OCTOBER, 1879.

Mr. MONTEFIORE in the Chair.

A paper was read by Mr. J. TREVOR JONES, on the "Expressions of the Emotions of the human Face." Mr. Jones illustrated his paper with impromptu sketches. The first diagram showed the position of the bones, and the second represented the various muscles. All the passions were illustrated in turn, showing what effect they caused on the different muscles.

FRIDAY, 28 NOVEMBER, 1879.

Mr. MONTEFIORE in the Chair.

This meeting was adjourned until 5th December.

FRIDAY, 5 DECEMBER, 1879.

Mr. MONTEFIORE in the Chair.

Mr. JOHN PLUMMER read a paper on art, entitled "Some principles of ornamental design, illustrated by an ivy leaf." The students of the Academy of Art were present by special invitation.

Mr. Plummer commenced the paper by relating the history of his early career as an art student, and displayed his first drawing in perspective, and studies from nature and the round. Mr. Plummer then exhibited various diagrams showing the ivy leaf, and a number of designs constructed from its outline.

Art Criticism.

By E. L. MONTEFIORE.

[*Read before the Literature and Fine Art Section*, 30 *May*, 1879.]

THE conflicting opinions which I have heard expressed in this room as to the merits of the various pictures which adorn its walls suggested to me the idea of saying a few words upon art criticism in general, not with the view of obtruding opinions of my own in any way, but of showing how opinions on works of art may differ, according to the different standpoints taken up by the observer, and of promoting a little pleasant conversation by interchange of thought on the subject. It has been said by an eminent art writer that it is an æsthetic fact that no two men ever "saw the same appearance in any object whatever." What men will see is determined beforehand by very complex conditions of faculties, experience, and education. What pleases us best is that which gives evidence of the qualities we most admire and approve. Some men base their opinions upon form, some on colour, some on composition; some think that all these should be subordinate to accuracy of drawing, and so on. It is, however, a well-known fact that human nature is rather inclined to condemn than to praise, to look for faults than to seek for beauties—that if a picture or a statue be deficient in some special quality upon which we base our judgment, we are apt to condemn it *in toto*. I think it may be safely said that few of the writers of the art critiques which appear from time to time in our journals form their judgment from previous education and study. They are, no doubt, familiar with the names of the great masters of this and former ages, and bring to their work a considerable amount of intelligence; but I believe they are mostly guided by what pleases their own particular taste, without regard to any recognized art canons, and possess very little of the theoretical knowledge which should constitute them trustworthy guides. Unfortunately, too, there is a general tendency on the part of art critics in public journals to give praise all round as a matter of policy, and thus such commendation loses much of its value. It is wonderful how a few telling stock phrases take the place of profound judgment and go down with the mass, who prefer to be led by other people's judgment rather than to exercise their own. It has been asserted that fewer qualifications are required by Parisian art critics than by any other writers for the French Press, and yet that the art criticisms in some of the French papers are perfect masterpieces of the kind of writing I have referred to. I do not, however, hold with some that a knowledge of art is indispensable in forming an

opinion of a work of art, any more than a knowledge of cookery is indispensable to form an opinion of a good dish. We all know what pleases our palate and what pleases our eye. Were an artist's fame to be solely dependent on the judgment formed of his works by other artists, he would sometimes come badly off. Artists as a rule are not the most lenient critics upon the works of a brother artist. An amusing instance of this is mentioned by Hazlett. A friend of his, he says, in reviewing an exhibition, had mentioned in terms of the highest praise the works of two brothers, and he was asked to be the bearer of the work containing the critique. Calling afterwards upon one of them, the artist expressed some thanks for what was said; but complained that the writer had fallen into a very common error of confounding his pictures with his brother's. "What is said of me," he remarked, "is all very well; but here," turning to the eulogistic remarks upon his brother's works, "this is all in allusion to *my* style; this is all in reference to *my* pictures; this is all meant for me." Not satisfied with the glowing eulogiums on his own works, he insisted on appropriating those on his brother's also. Whatever appeals direct to the senses can be appreciated by any one, whether he be peer or peasant, in different degrees. It needs not the eye of a painter only to appreciate what is beautiful in form and conception; although there can be no doubt that his artistic knowledge may detect faults or see beauties which, with the uninitiated, would pass unnoticed.

As illustrating differences of opinion, I have heard some would-be art critics aver of Corbould's "Lady Godiva" that there is nothing in it to admire, whilst others have been as loud in its praises. May it not then be fairly assumed that there are points in it to condemn and points to admire, and that it is neither deserving of indiscriminate praise nor indiscriminate censure? Probably in the one case the observer judged of the entire work by Godiva's heavy charger, or by the anatomy of the principal figure, which did not please him; or, being a very close observer, he may have remarked that the tower in the background was slightly out of the perpendicular. On the other hand, these apparent defects were doubtless lost sight of in admiration of the brilliant colouring, beauty of composition, and high finish. I may here give the words of an experienced critic in the *Art Journal* in reference to this picture:—"Edward Henry Corbould's 'Lady Godiva,' riding forth, clothed with chastity, is full of detached beauties, but does not, on the whole, convey a satisfactory impression: to use a paradox, it would have been a better picture had it been worse painted." I hold in my hand an autograph letter sent by the Princess Louise—who, by-the-way, was a pupil of his—to Mr. Corbould, on the completion of this picture, which may be interesting my hearers. Take, again, my friend Mr. Du-

Faur's fine painting of the "Tribute Money." Whether it be an original Rubens or not, most people will acknowledge it to be a very fine work; yet there are those who would condemn it in consequence of the plebeian face to the right, ignorant of the fact that many of the old masters were in the habit of introducing into their pictures the portraits of their patrons; hence, no doubt, the head in question, which in its type and character differs entirely from every other head in the picture. Amongst our water-colour drawings may be seen a cattle-piece by Brittan Willis, acknowledged to be one of the best cattle-painters of the day. Yet I have heard that picture condemned because of one impossible cow's tail. If we approach the acknowledged art works by great masters, either of the ancient or modern school, with the desire of finding something therein to condemn, I will venture to assert that there are few in which we cannot find some peg on which to hang our censure. What does Fuseli, one of the most accomplished and eloquent art critics of the present century, say, in commenting on Rubens, the great master of colour: "It was not to be expected that correctness of form should be the object of Rubens, though he was master of drawing, and even ambitious in the display of anatomic knowledge; but there is no mode of incorrectness, unless what directly militates against his style, such as meagreness, of which his works do not set the example. His male forms, generally the brawny pulp of slaughtermen; his females, hillocks of roses in overwhelmed muscles, grotesque attitudes and distorted joints, are swept along in a gulph of colour, as herbage, trees, and shrubs are whirled, tossed, and absorbed by inundation." What does he say of Rembrandt: "He was a genius of the first class in whatever relates not to form; in spite of the most portentous deformity, and without considering the spell of his chiaroscuro, such were his powers of nature, such the grandeur, pathos, or simplicity of his composition, from the most elevated or extensive arrangement to the meanest and most homely, that the best cultivated eye, the purest sensibility, and the most refined taste, dwell on them equally enthralled. Shakspeare alone excepted, no one combined with so much transcendent excellence so many in all other men unpardonable faults, and reconciled us to them; he possessed the full empire of light and shade, and of all the tints that float between them; he tinged his pencil with equal success in the cool of dawn, in the noonday ray, in the livid flash, in evanescent twilight, and rendered darkness visible. Though made to bend a steadfast eye on the bolder phenomena of Nature, yet he knew how to follow her into her calmest abodes, gave interest to insipidity or baldness, and plucked a flower in every desert." I have been tempted to give this somewhat lengthy extract, although not necessary for my subject, seeing that it is such an eloquent tribute to the genius of one of

the greatest masters that ever lived. The same critic, however, tells us that "the female forms of Rembrandt are prodigies of deformity; his males, the crippled produce of shuffling industry and sedentary toil." Of Vandyck, he says "the line is balanced between Flemish corpulence and English slenderness." Of Titian, "The forms of Titian are those of sanguine health; robust, not grand; soft, without delicacy." "Elegance," he says, "was the principle of Parmigiano's line; but he forgot proportion." The forms of Caravaggio he describes as "either substantial flesh or the starveling produce of beggary rendered important by ideal light and shade." The women of Annibale Carraci are made up, he tells us, by imitation or vulgarity; those of Guido are actresses; of Parmigiano, coquettes; the women of Raffaelle are either his own mistress or mother—his goddesses too ponderous for aerial forms and amorous conceits; and the females of Titian he describes as "the plump, fair, marrowy Venetian race." Michael Angelo, no mean critic, attracted by Titian's celebrated picture of Danaë, which we have been assured is now in Sydney, lamented that that great artist had not studied the antique as accurately as he had Nature, in which case his works would have been inimitable by uniting the perfection of colouring with correctness of design. Whilst speaking of Titian, I may be permitted to repeat the following anecdotes, as showing the estimation in which he was held by monarchs:—When the pencil fell from his hand, Charles V. of Spain took it up, and presenting it to him said, "It becomes Cæsar to serve Titian." And Philip IV., when he heard of the destruction of the Prado, impatiently inquired if the Titian Venus had escaped, and on being told that it was safe, replied, "Then every other loss may be supported." [Apropos of this said Danaë. Without wishing to detract from the merits of the work in Mr. Fielding's gallery, I would call attention to the fact that Louis Viardot, an accomplished writer on art, in his work, "Les Merveilles de Peinture," written within the last ten years, in speaking of Titian, dwells specially on this famous painting, and describes its exact whereabouts. It is difficult to reconcile this with the assertion of its having been stolen some half century before. Since jotting down these remarks I have seen a letter from Herr Gresner, the Director of the Royal Gallery at Dresden, which speaks positively of the picture being still at the Museum in Naples in all its pristine beauty, in the so-called Sala de Correggio No. 5.] What says Sir Joshua Reynolds of another great artist, Correggio: "His colour and mode of finishing approach nearer to perfection than that of any other painter; the clearness and transparency of his colouring, which stops at that exact medium in which the purity and perfection of taste leaves nothing to be wished for." Whilst Fuseli eloquently remarks: "Another charm was wanting to complete the round of

art—harmony; it appeared with Antonio Leti, called Correggio." But to show that fault might also be found with his works, the same critic tells us "that sensuality personified is the general character of his females, and the grace of his children less naiveté than grimace, the caricature of jollity." Another accomplished art critic, Dufresnoy, says: "His manner, design, and execution are all great, though incorrect; he had a most free and delightful pencil, and he painted with a strength, relief, sweetness, and force of colouring which nothing ever exceeded. His design often appears lame, and his positions are not always well chosen; the look of his figures is sometimes unpleasing, but his manner of sketching the heads, hands, feet, and other parts, is well deserving of imitation." I would that the students in our own school would take example from this master, and would endeavour to acquire a thorough knowledge of drawing before attempting to copy ambitious pictures; in fact, would learn to walk before they attempt to run. But for Titian one of Correggio's masterpieces of art, "The Assumption of the Virgin," in the cupola of the Cathedral of Parma, would have been lost to the world. The canons of the church condemned the work on its completion, and would pay the artist only half the moderate sum agreed upon for it. Whilst Titian, in passing through Parma, was rapturously gazing on the work, he was told by the dignitaries that it was not worthy his notice, and that it was intended soon to deface it. Titian started with horror at the intended profanation, and exclaimed: "Take care what you do! Were I not Titian I would wish to be Correggio." It may be mentioned that to this picture Correggio owed his premature death. The canons paid for it in copper money, loaded with which Correggio had to travel seven or eight miles. The weight of his burden, the heat of the weather, and the depression of his spirits threw him into a fever, to which he succumbed in three days, at the age of about 40. Of Raphael Sanzio, the father of dramatic painting, it has been said: "If separately taken, the line of Raphael has been excelled in correctness, elegance, and energy; his colour far surpassed in tone and truth and harmony; his masses in roundness, and his chiaroscuro in effect. Considered as instruments of pathos they have never been equalled; and in composition, invention, expression, and the power of telling a story he has never been approached." The same eloquent writer, speaking of Salvator Rosa, says: "Terrific and grand in his conception of inanimate nature, he was reduced to attempts at hiding by boldness of hand his inability of exhibiting the impassioned, or the dignity of character; his line is vulgar; his magic visions, less founded on principles of terror than on mythological trash and caprice, are to the probable combinations of nature what the paroxysms of a fever are to the flights of vigorous fancy. Though so much extolled and so ambitiously

imitated, his banditti are a medley made up of starveling models, shreds, and bits of armour from his lumber-room, brushed into notice by a daring pencil."

The recent action, Whistler *v.* Ruskin, furnishes us with an excellent illustration of how opinions differ upon works of art. Ruskin, in a pamphlet entitled "Fors Clavigera," which severely criticised the modern school of art, referring to Mr. Whistler's eccentric productions styled "Nocturnes" and "Arrangements," exhibited in the Grosvenor Gallery, remarked that for Mr. Whistler's own sake, no less than for the protection of the purchasers, Sir Coutts Lindsay ought not to have admitted works into the gallery in which the ill-educated conceits of the artist so nearly approach the aspect of wilful impostures. "I have seen," he said, "much of Cockney impudence before now, but never expected to hear a coxcomb ask 200 guineas for flinging a pot of paint in the public face." This was trenchant criticism with a vengeance. What said the experts who were called on to express opinions on Mr. Whistler's works? Mr. W. M. Rossetti, the well-known art critic, "admired them sincerely." Mr. Albert Moore, an artist, considered them "beautiful works of art." Mr. Wills, dramatic author and artist, considered that they were those of "a man of genius; *audi alteram partem* Edward Burne Jones, the well-known artist, speaking of one of his works, said "in no sense whatever did it show a complete work of art;" that neither in composition, nor in detail, nor in form, had it any quality whatever. Another he described as being even "more formless;" of a third, "as not having even the merit of the other two." Frith, the R.A., said that he did not consider Mr. Whistler's pictures serious works of art; there was beautiful colour, but no more than could be had on a wall-paper or piece of silk. Mr. Tom Taylor, the well-known art critic, considered them only one step nearer pictures than delicately tinted wall-paper. When we thus see how doctors differ, it behoves us with our untutored eyes to be more modest than we usually are in giving our opinions. Baron Huddlestone, in the course of the above trial, repeated an amusing anecdote, which, although it may be known to many of you, will bear repetition. The counsel for the defence wished to produce a picture, by Titian, in Court, to show what was a finished work. The Baron thought this was going too far, as he would first have to prove that it was a Titian, and referred to the story of the "genuine" Titian, purchased by some artists to determine the secret of that master's wonderful colouring. On being rubbed down the explorers found a red surface, and exclaimed, "Here is the secret," but on going a little further with the process it was discovered that the red substance was a portrait of George II. in militia uniform. Some of the works of the great Turner, the most poetical artist of modern times, have not escaped adverse

criticism. Ruskin, one of his most devoted worshippers, described his "Snowstorm" as "a mass of soapsuds and whitewash"; and Frith, whilst highly eulogizing his early works, held that his latest productions were as insane as the people who admired them.

The tendency of the criticisms I have referred to shows us that we should not base our judgment on an artist's work by some exceptional feature therein, but on its effect as a whole. Whilst some revel in colour, regardless of form, others consider that the one should be subservient to the other. It is quite certain that in no artist's works, however celebrated, shall we find absolute perfection. Frequently we are apt to condemn a picture as untrue to nature simply because we may not have seen the object from the same point of view, or under the same conditions as regards light and shade as the artist, oblivious of the fact that Nature's moods are ever varying. We may go out to-day, and the waters of our beautiful harbour will appear a deep blue; to-morrow we may find them a cold gray. Nothing can be more changeable than mountain forms. An art writer describes them as the most unstable in the world, except those of the sea waves. A great rough boss on the side of the mountain is its principal feature one minute; the next you cannot find it. Seek it as you will you cannot find it any more than if the thing had been fairly chiselled away by the hand of a mighty sculptor. Rocks alter in apparent shape as the light changes; a wreath of mist creeps stealthily, and shows you a chasm you never suspected yesterday; a sunbeam falls, and a giant crag leaps out to bask in it like an eagle from the copse. Clouds can never be painted accurately from Nature, seeing that the slowest of them rapidly changes; the most that an artist can do is to take a rapid pencil outline and hasty note of colour. Every one of my hearers has no doubt seen most remarkable clouds, which if portrayed on canvas would be pronounced as utterly unnatural by those who had not actually seen them.

Many of our best writers will, however, tell you that fine art is not a mere slavish imitation of Nature; indeed, if it were so, what should we say of some of the gorgeous landscapes of Claude and Turner? Turn to the charming landscape by Pyne on the walls of the Academy: I doubt if any one of us would consider the brilliant colours to the right as true to Nature. Let any one attempt to arrange drapery as he may see it arranged in some of the noblest works of the best masters, and he will see how much is done by the creative powers of the artist. Leonardo has said that a looking-glass is the master of painters, and that the way to test the excellence of a picture is to set by its side a mirror containing a reflection of the reality; yet, as Hamerton observes, nobody ever saw in a looking-glass, and it may be safely affirmed

that nobody will ever behold in any looking-glass, not bewitched by necromancy, such an arrangement of form and line as we have in Leonardo's "Last Supper."

I will conclude with an aphorism from Fuseli, asking you to excuse these hastily thrown together remarks, time not having permitted me to enlarge on a subject on which I feel that so much more might be said: "If mind and organs conspire to qualify you for a judge in works of taste, remember that you are to be possessed of three things—the subject of the work which you are to examine, the character of the artist as such, and, before all, of impartiality. All first impressions are involuntary and inevitable, but the knowledge of the subject will guide you to judge, first of the whole, not to creep on from part to part, and nibble at execution before you know what it means to convey; the notion of a tree precedes that of counting leaves or disentangling branches. Every artist has, or ought to have, a character or system of his own. If, instead of referring that to the test of Nature, you judge him by your own packed notions, or arraign him at the tribunal of schools which he does not recognize, you degrade the dignity of art, and add another fool to the herd of dilettanti; but if, for reasons best known to yourself, you come determined to condemn what yet you have not seen, let me advise you to drop your pursuits of art for one of far greater importance—the inquiry into yourself; nor aim at taste till you are sure of justice."

The Black Forest:

From Notes taken by L. Hart, during a tour in Germany in 1861.

[*Read before the Fine Art Section*, 27 *June*, 1879.]

The name brings to most minds visions of robbers, murderers, impenetrable thickets, dangerous wild beasts, and who knows what other horrors. The country is comparatively unknown, and therefore more or less unexplored by tourists. It cannot be said to have become fashionable, and therefore is supposed to be still uncivilized. But when the traveller, either from love of novelty or curiosity of any kind, is induced to penetrate this unknown region, he is surprised to find much the opposite of what he had expected. The country is as grand if not far grander than he had imagined —the wild beasts are simply wild boars, roe deer, and such like game. The inhabitants, if somewhat rough from want of frequent communication with the outer world, are honest and friendly. Villages and farm-houses are met with in every direction,—where the forest is thick it is intersected by innumerable paths, fountains meet the thirsty wayfarer at every turn, seats placed where magnificent views are cut out in the forest invite him to rest, while green meadows, rushing torrents, and rocky precipices afford such variety as can probably be found nowhere else--not even in Switzerland, in the course of one day's walk. While there are spots like the far-famed Höllenthal or Valley of Hell, the Albthal, or the scenery of the Felburg, of a wild and even savage character, there are others like the Murgthal near Baden Baden, or Günthersthal near Freiburg, or the Baths of Baden Weiler, whose chief beauty consists in their very quiet and peaceful repose. Any one studying the aspect of the Black Forest country on the spot, or even on a good map, will see traces in its formation of the violent action of fire and earthquake, as well as of the softer influence of water. Abrupt walls of rock, gently rounded hills, traces of ancient lakes of vast extent, now reduced in some cases within narrow limits, in some cases wholly dried up, are to be found on all sides; granite, porphyry, sandstone, and alluvial deposits are blended together, sometimes covered by the thick forest, sometimes cleared and open for miles around. Its natural productions are numerous, as might be expected. Antimony, silver, iron, rock crystal, agate, amethyst and opal, and in some parts garnets, rank among its more valuable treasures.

In botanical treasures the Black Forest is very rich, possessing some thirty specimens peculiar to itself, and others common to it with the Alps, Jura, and Vosges. The immense variety of soil and differences of elevation make the flora of this region a

sort of epitome of that of Germany and Switzerland. The Romans knew the forest as the Sylva Marciana, forming the south-west corner of the great Hercynian Forest, which extended through the middle of Germany, the length of which is estimated by Cæsar at sixty days' march. Modern geographers reckon the Black Forest to extend from the Rhine near Bale in the south-west, up to Bruchsal and Pforzheim on the north-east; on the west it is bounded by the wide plain forming the Rhine valley, and on the east it dies away gradually in the high table-land of Würtemburg.

The number of its inhabitants amounts to about half a million, of whom 133,000 belong to Würtemburg, and the remainder to the grand duchy of Baden. It is divided into the upper Black Forest, between the Rhine at its southern extremity, and the valley of the Kinsig flowing by Offenburg, where the hills attain a mean height of 3,000 feet above sea level. The lower portion, from the valley of the Kinsig northwards, has a mean height of 2,000 feet, and its highest points reach only to some four or five hundred feet more. As a rule, the hills rise abruptly from the Rhine valley on their western side and sink gradually in other directions.

The accounts left by the Romans people the Black Forest with horrors of all kinds, and possibly through these traditions has its evil name been handed down to our own day. The earliest inhabitants who left any traces were the Celts, but it is probable they did not penetrate far into the Forest; such names as with any certainty can be traced to them are usually found on the western side towards the Rhine valley, whilst the names deeper in the Forest are purely German. Little by little, charcoal-burners, herdsmen, woodmen, and others pursuing similar occupations penetrated the recesses hitherto tenanted by bears and wolves, until the whole district was peopled. The highest inhabited part of the Forest is about 3,940 feet above the level of the sea. The gradual process of peopling has in many cases been traced out by means of ancient documents, showing that much was due to the monks, who in seeking out spots retired and free from disturbance, set an example which was followed by many neighbouring proprietors.

And so the Black Forest changed its aspect. Already in the 15th Century it is spoken of as thoroughly peopled and cultivated. In the following century an ancient chronicler speaks of it as a rough and cold country, mostly covered with pine forests, but yet, through the industry of its inhabitants, producing a fair amount of corn, and better cattle than Hungary, Poland, Bohemia and Switzerland; nor does he forget to mention its medicinal and other springs, known before by the Romans, but at this time again coming into notice.

As was to be expected, however, the chief Black Forest trade was in wood; other productions sufficed for home consumption, but this was the source of that well-being that even to the present day distinguishes the inhabitants. As the population grew larger, it was necessary to seek some other means of subsistence, and the staple industry of many districts of the Forest commenced. In the 17th Century clock-making was introduced, and, with the kindred trade of musical boxes, has ever since employed a considerable population.

There are also various other branches of industry pursued in the Black Forest; glass, and the coarser kinds of pottery, straw hats, and brushes are made in large quantities, and of late years a considerable number of cotton and wool manufactories have been established, more particularly in the southern half, where they were first introduced about a hundred years since, and were fostered by the now suppressed monks of the Abbey of St. Blaise. The aspect of comfort and solidity in the houses and villages of the Black Forest is a subject of astonishment to every stranger who passes through it, and furnishes a striking contrast to the state of the lower orders in most other countries in Europe. The whole secret of this prosperity lies in the rough and hardy education which the inhabitants as a race have undergone, and which has left its impress too strongly upon the character for it to be speedily effaced by even the growing luxury and free communication with the outer world of the present day.

The German proverb "Aller Anfang ist schwer" has proved nowhere more true than in the history of the peopling and cultivation of the Black Forest. Every little gain had to be diligently laboured for, and came to be prized almost in proportion to the difficulty of obtaining it. Before even a crop of oats could be grown the land had to be cleared and the ground prepared, requiring the labour of several years. Moreover the difficulties of transport, in the almost total absence of communications, are in the present day inconceivable. Many and many a wayside cross or small chapel tells of some fatal accident connected with the early settling and clearing of the country. Nor had those inhabitants who busied themselves chiefly with pasturing cattle fewer difficulties with which to contend. Even down to the 15th Century the wolves, now wholly extinct, committed extensive ravages, and obliged the herdsmen to take precautions now unknown, while many a danger and difficulty now forgotten kept the people in a constant state of preparation and watchfulness.

And so the race grew up, hardy, enduring and temperate, protected by its poverty and separation from many things which ruin richer and more luxurious tribes.

When the manufacturing industry of the Black Forest first arose, the ambition of each man was to found for himself a house,

with perhaps a field and a cow. He carried himself the produce of his labour on his own back to distant parts, and living as frugally there as at home, gradually amassed a sufficient sum to crown his wishes with success.

This is, in the case of nations as of individuals, the only sure road to prosperity; hardiness, patient endurance and diligence in youth, lead to competence in old age. And even now, when the inhabitants of the Black Forest are as a people prosperous, they preserve much of their original simplicity.

It is everywhere observed that the people inhabiting a mountainous country preserve their hereditary distinctness of dress, customs and manners, much longer than the dwellers in plains; and this is especially true in the case of the Black Forest, where there are few level tracts, as in North Germany, inviting communications and commerce. The consequence is that, amongst the people, a considerable amount of ancient customs and dresses are still to be found, although fewer and fewer every year, while different causes and the lapse of time have in some cases more or less modified the original types. Not the least among these disturbing causes have been religious differences.

Because the Catholic population used bright colours and joyous expressions, the Protestants employed black for many parts of their dress and gave utterance to their feelings in solemn words, marking the distinction as was done in England by the Cavaliers and Puritans.

The characteristic dresses of the Black Forest must however be allowed by all, even where sombre, to be at least picturesque, and many may claim a right to be handsome. Black knee-breeches, white stockings, a scarlet waistcoat, a coat of grey, black, or brown cloth lined with scarlet or white, a large black necktie, a felt hat with a prodigious brim, make up the usual dress of the male population. That of the fair sex is not easily described; a singular kind of skirt or petticoat, an apron with many plaits, a low body of some bright colour, sometimes laced across the breast, a linen or muslin cloth above this; these with an endless variety in the headdress, are some of the usual points in which the costume of the country displays itself. But every district has its distinctive mark, either in material, colour or form, especially in the female dress; and not only has every larger valley a costume differing in some respects from that of all others, but even in the case of neighbouring villages, where a stranger might perceive no difference, the native's experienced eye would detect it, and by some knot, cut or button, assign every person he might meet to his or her own home.

This originality of dress extends even to the local military. While the writer of this paper was staying at Petersthal (a watering place of medicinal note), the Grand Duke of Baden was to pass through the village. A guard of honor was formed to receive the sovereign;

the men turned back their coat-tails, the red lining making them appear like some of Napoleon's old guard, the broad-brim hat was arranged in proper fashion and trimmed by the addition of a cockade; poor old brown bess, that had been for years lying quietly over the chimney, was taken down and carefully repolished, &c., and so the army was ready for—inspection. The day over, coat-tails fell back into their proper place again, the cockades were returned to the fair hands that prepared them, to be kept as mementoes of the valour of their fathers, husbands, or lovers, and the inoffensive weapon once more reposed in tranquillity in its habitual place.

This variation in the dresses of the inhabitants of the Black Forest is however equalled by the diversity of their dialects. As every county in England has its own distinctive accent, pronunciation, and even distinctive words, so is it with the various districts of the Black Forest. The two chief tribes who people this country, the Alemanni and Suabians, have left their traces upon the language, and beside these, most valleys, and even parishes, have, as in their dress, so also in their language, some peculiarity easily distinguishable by the practised ear. The purest form of the south-west German dialect is probably to be found in the highest parts of the central Black Forest, about Lengkirch, Neustadt, &c. The Swiss and Alsacians have given a coarseness of accent to the district which they bound, which gradually loses itself as the people are removed further from its influence, but in the whole district the grammatical forms are purer than in many parts of the north of Germany.

Among the customs and sports which have been handed down from the remotest antiquity are pre-eminent, here as elsewhere, the Christmas and church dedication feasts, marriages, &c. In some towns, at the Carnival, exists an old custom called "Hansellanfen." A man dressed up in motley garments, and furnished with bells, goes about and introduces himself in the various groups of holiday-keepers, teazing them to the utmost of his power by jibes, criticisms on their past or present acts, and in every other way his wit can suggest.

The ancient free country of the Baar, on the high ground of the eastern Black Forest, in which the Danube has some of its springs, furnishes another subject, the "Hahnen-tang-Gasnm Tang," a dance of which a cock is the prize. In the middle of the room the fowl is placed aloft on a perch, under which a stand is hung containing a glass. When a couple in their dance come under the glass, the lady sinks on one knee, and with her right hand, on which the man places one foot, raises him as high from the ground as she can reach. If by this means he can, with his head, throw down the glass, the prize is won and the merry-making continues in still more boisterous fashion. Many more similar amusements still exist among this people, especially among the outlying

districts, but every year sees the end of some of them. The people are gradually becoming too much spoilt by contact with the outer world to take pleasure any longer in amusements which sufficed for a simple age.

Those who purpose visiting the Black Forest should do so in the height of summer, not only because the temperature and weather are then more suitable, but also because the character of the higher country is then seen to the best advantage. The highest mountains freed from snow are easily ascended, and the sight of the distant Alps gradually lighted up by the rising sun forms a sight which must be seen to be appreciated, and which will never fade from the memory.

The Feldberg, the Belchen, and the Erykasten may be considered types of the high Black Forest hills, and are respectively 4,890 feet, 5,685 feet, and 4,635 feet above the level of the sea. The summit of the Feldberg is flat and perfectly devoid of trees. From this point can be seen the four great arms of hills which stretch from this giant towards the four quarters of the compass, and which, with their dependent ridges and valleys, make up almost the whole of the Black Forest mountain group. Through this lofty group almost all the chief passes of the forest make their way, at the commencement usually deeply cut in the mountains, but gradually rising till they cross the watershed between the Rhine and the Danube, at a height not far below that of the chief summits.

Of these the most celebrated is the Höllenthal, through which the unfortunate Marie Antoinette passed, on her way to marry the French King Louis XVI, and through which also, subsequently, Moreau conducted his celebrated retreat, in 1796, without any loss. Its height is 2,980 feet above the sea level. The highest pass in the Forest is over the Belchen, at a height of 3,640 feet.

In this high and wild country lie also embedded several lakes, but none of any great extent. The chief are the Feldsee, on the east side of the Feldberg, the Titisee, the Schluchsee (a lovely little lake surrounded by fine forests), and the Nonnenmat Weier See, in which is a floating island. In the northern district is the Mummelsee and a few other. They never exceed a depth of 200 feet, and are mostly full of fish. Much, however, of the charm of the Black Forest lies in its valleys. In many of them, especially in the higher regions, tower over each other masses of granite, gneiss, porphyry and other rocks, shooting up sometimes abruptly many hundred feet, or filling the valley with a troubled sea of rocks; through this a mountain torrent forcing its way, here hidden under some overgrowing crag, there falling from one terrace to another, and leaving frequently no room even for a foot-traveller to force his way between the walls of rock and itself.

"See yorder gulf yawn in the purple hills,
No morning ray there drinks the early dew,
No voice is heard, save when afar complains
The croaking frog, sole in the cheerless vale.
The wild bird revels in the lonely wood,
And sadly creaking turns the infrequent wheel,
Where lonely stands the peasant's darksome home,
And pois'nous fungi choke the sunless glade.
In misty twilight high the towering rocks
Dart up their peaks; there sounds no harvest song,
No wheaten load e'er glistens in the sun;
The guerdon of the ploughman's arduous toil,
The joyous cries of reapers there are still,
Nor proud stream bears the richly freighted barque.
Down horrid rocks the torrent's dashing spray
Falls, and is lost 'mid the surrounding gloom." *

One of the most striking valleys reaching from Säckingen, near Bale, towards the Feldberg, is worthy of special notice. About 1½ hour's walk from the first-named place, at the foot of the ruined castle of Barenfels, the narrow valley commences, being about one hundred and fifty yards wide, but it soon narrows to as many feet, and at last to very few, so that the road has in some parts been necessarily constructed in the very bed of the torrent. Another twenty minutes leads to a most interesting spot. Here huge masses of rocks tower aloft, sharply cloven as by the ponderous blows of some huge giant, rising many hundred feet, and decked on their summits with a garland of shrubs and creepers. A large amphitheatre opens, the walls of this character, the centre filled with huge masses of rock in the wildest confusion; no human sound or habitation is perceptible—nothing but the torrent's rush or cry of some bird of prey breaks the silence. At last the upper end is reached, and green meadows, through which the now silvery waters wind their way, make a glorious panorama, and, not the least, the habitations of men form a delightful change.

With a few words about one of the natural beauties of the Black Forest I will conclude this rather disjointed paper.

There are, as might be expected in a mountainous district containing so many kinds of rock, caverns of various sorts. A very fine natural stalactite cavern called the Haseler Hökle is worthy of note. Through a passage of some three feet wide and eight feet high the traveller penetrates into a lofty hall, full of broken fragments of rock. On the left, through another cavern, and mounting some steps, a bridge is reached, under which a torrent rushes, supposed to communicate with the Rhine under ground. Above, the roof is studded with ponderous stalactites. There are passes and steps leading to other vaults, all more or less beautiful, in one of which is a motionless lake.

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* Translation from Schutt.

Little wonder, then, if the ancient inhabitants of the country peopled these caves with creatures of their own imagination, and if the belief has hardly died out among their simple descendants at the present day.

The spirits of fire and water, tamed to obey the will of man, now pass near this spot, and the railway has even laid bare an entrance to one of the caves near that described, and I much fear that a journey now made through the Black Forest would lose much of the interest that it had in the year 1861.

Art Instruction.

By John Plummer.

[*An address to the Literature and Fine Art Section of the Royal Society of N.S.W.*, 5 *December*, 1879.]

Successful progress as a student in a school of art does not necessarily imply the acquirement of instruction in the principles of ornamental design. The student is taught the use of the pencil, but this no more entitles him to be regarded as an art designer than a knowledge of the alphabet enables him to become ranked amongst popular authors. The means must not be confounded with the end. A knowledge of drawing is essential to the art workman who desires to excel; for although it is possible for him to be unable to use the pencil, and yet possess some insight into the leading principles of ornamental art and the manner in which they may be most effectively applied, still without some power of drawing he would find it difficult to give adequate expression to his ideas. Had a knowledge of drawing been more common in England during the earlier portion of the present century, the principles of ornamental design would have been better understood by English artisans, and she would have occupied a more prominent and stronger position in the industrial world. As it was, there existed amongst masters and men the most absurd and erroneous impression respecting the introduction of ornamental art into the workshop. It was held that elegance of form could only be obtained by the sacrifice of solidity of construction or elegance of quality. Hence there was a lavish use of materials resulting in unnecessary strength, heavy cost, and disproportionate artistic effect, of which the huge iron railings which surround St. Paul's Cathedral in London furnish an instructive illustration. In like manner, if a dining-table were ordered for a gentleman's mansion, it was made almost as heavy and massive as a carpenter's work-bench, although not intended to be subjected to a strain more severe than that occasioned by the weight of a few dishes and plates. It was the same in every department of manufacturing industry. British glass-ware, pottery, metal-work, furniture and joinery, were characterized by great solidity and strength, combined with a marked absence of taste. One result of this was that the race of art-workmen, so numerous during the Elizabethan period had almost become extinct in England, and whenever work of a really decorative character was required the labour had to be imported from abroad. This circumstance gave rise to a long prevalent, but erroneous impression, that the English labouring classes possessed no instinctive love of art—that even were they educated in the principles of ornamental design, they would be

always imitators, having no original genius of their own. But those who held this doctrine forgot the shameful state of ignorance in which the great mass of English working people were being reared; how the doors of museums and picture galleries were closed against their entrance; and how every opportunity of elevating and refining their tastes was denied them. Looking back at the art progress made by English workmen during the last thirty or forty years, every possible ground for encouragement is to be perceived. No nation in modern times has made such enormous strides in the knowledge of ornamental art and its various industrial applications as those effected by the English people. At first there were symptoms of hesitation, and at one time their schools of design were loudly proclaimed a failure, as if it were possible for a child to run before it had learned to walk; but the right chord had been struck, and it was not long before even the most incredulous began to admit that the production of an English art-workman was not quite an impossibility. The results of popularizing art education in England are to be beheld in every direction, even in the abodes of the humblest toilers. There is no object of utility, however apparently insignificant, which is not capable of being adorned or beautified. Take the commonest dinner-plate used by a labouring man. The old tasteless Chinese willow pattern has disappeared, and become replaced by a design more or less pleasing even to the untrained eye. This, in itself may not appear very important, but when it is considered that the preparation of every new design signifies the employment of a designer or art-workman, it is easy to perceive that the diffusion of art taste among the people means something more than popular refinement—it signifies a wide extension of the field of remunerative employment. The recent history of English industrial art furnishes numerous instances in which workmen who have devoted their leisure hours to the acquirement of art knowledge have been enabled to successfully make use of the same in bettering their position, both socially and financially. But there is one thing which has frequently prevented working men from attempting to master the principles of ornamental design, and that is the obscure character of the language and allusions too often made use of by teachers, who forget that their pupils are not always versed in art history or art theories. Many of the popular errors in connection with ornamental design arise from its being confounded with what might properly be designated design in ornament. There is a wide and essential difference between the two, although they have much to do with each other. Ornamental design refers to the general design of an article, its shape, proportion, material, colour, and style, together with the character and amount of any purely decorative details. Design in ornament applies chiefly to the latter. The designer who can excel in both

branches stands at the head of his profession; but as a rule, there are few who can fairly claim that high position. They may excel in producing designs intended to be judged as a whole, but fail to achieve success in the details, where they are generally content to remain mere copyists of ancient art workmen. For instance, a vase of classic design is required. The designer selects or invents a form of great beauty and elegance, but borrows the whole of the details from other articles of a like character; hence the lack of real originality in such productions. The ancient Greeks did not act on this principle, they derived their inspiration direct from nature. A simple leaf suggested to them a great variety of ornamental forms. The modern designer takes the same leaf and contents himself with reproducing it; but this is not design, it is simply imitation, although dignified by the appellation of "decorative art." On the Continent the principles of design in ornament are better understood—hence the greater success of French, Italian, and German art workmen in imparting an air of novelty to many of the simplest productions, without pandering to a morbid taste for the unnatural or false in art. A continental designer adapts his ornamentation in accordance with the general design. He may derive a hint or two from previous labours, but he studiously avoids slavishly repeating in one design the ornaments utilized in another, unless with certain variations intended to prevent too close a resemblance between both. In England, on the contrary, the same ornament is used over and over again in a stereotyped form, for articles of the most diverse design, very frequently without the least regard to fitness. Here arises another cause of English inferiority in industrial art. The continental art workman, accustomed to practise his skill in the reproduction of good designs, insensibly acquires a certain amount of sound taste, which renders him something more than a mere handicraftsman. Hence the wondrous delicacy, often approaching to genius, characteristic of the workmanship of many foreign artisans employed in the production of the more elaborate and costly art objects. In England the absence of such a valuable and efficient training has not only tended to prevent any increase in the numbers of skilled art workmen, but also to limit the extent of their practical knowledge and capabilities. As Mr. Redgrave remarked, more than a quarter of a century ago, in England, the greatest difficulty consists less in the want of designers than of skilled art workmen to carry out the designs. "A design for cotton printing may be spoiled by the putter on; or for silk, by he who prepares it for the loom. The sculptor may design a statuette, but there are few able to chase the bronze or to retouch the clay, or to unite the parts when they come from the mould. Even when such are found, they are mostly men of small minds, who enter little into the spirit of the artist's labours, and who work without

feeling as to fire. We find plenty of chasers able to imitate the fur of animals or the texture of draperies, but few who understand the bones or the anatomy of the parts, and fewer still who carry an artist's spirit into their works. In painting, also, the painter on glass and china is generally a mere copyist, or he works too entirely by rote and without feeling. The lily and the rose which he paints are always the same lily and the same rose, a work of the hand and eye in which the mind has no share. There are honorable exceptions, no doubt, but with the many art is a mere handicraft." These words hold good now, although less extensively, as at the time when they were first published. As a rule, the ornamentist is unacquainted with the principles of design. He can reproduce—often with some degree of taste—forms with which he is acquainted, but he cannot use them as hints for new and even more graceful shapes. Give him a honeysuckle, and he will produce a very artistic imitation, but his deficient knowledge of the principles of design prevents his following the example of his Greek predecessors, and creating a wholly new and elegant form of ornament therefrom. Hence the excessive use of natural forms, which, however tastefully arranged they may be, render but too conspicuous the absence of real design.

It is easy to trace the history of design in ornament. If we take the war implements of a tribe of savages we shall find the handles of their clubs ornamented with a series of parallel, straight, or curved lines; afterwards, the design becomes more elaborate. There are cross curves and cross lines. Then comes the attempt to represent natural objects, or forms borrowed therefrom. Very frequently the latter possess much grace, notwithstanding the rudeness of workmanship. But as they advance in civilization, they content themselves with merely imitating any object which strikes their fancy. They are no longer designers. The reason of this is clear. Finding the imitative faculty more easy to indulge than that of invention, they naturally neglect the latter. Hence the decadence often observed in the later periods of savage art. The modern red Indian has lost the rude yet inventive tastes of his less civilized forefathers. The same phenomena is noticeable in the history of civilized peoples. There was a period when English wood-carvers almost surpassed their Flemish and other continental instructors, but as they sank from being designers into becoming mere imitators, the art gradually declined and became almost lost in England. In France the principle of design in ornament is understood perhaps better than in any other country, although the knowledge is not always applied in the wisest manner, hence the wonderful taste displayed in the production of articles intended for personal adornment. Give an English designer an ivy leaf and he will reproduce the natural form with marvellous precision, but the

French designer will create an entirely new form, of the most artistic and graceful character. Yet there is no reason why the English designer should not be equally skilful; it is purely a matter of technical training. That the Frenchman or German naturally possesses a greater talent for the art of ornamental design than does the Englishman is not correct, although it is perfectly true that at present the latter is last in the race. But this arises not from any deficiency of a natural aptitude for art, but from the absence, until recently, of facilities for acquiring a knowledge of its principles and applications. The Englishman has had to remain content with being an imitator, to borrow the ornamental designs from abroad, and to admit his inferiority in that in which he ought to have excelled. All this is gradually becoming changed; but much remains to be done, especially in diffusing a knowledge of the true principles of ornamental design. In designing an article, say a picture-frame or a lamp-stand, the first thing to be considered is the size and proportions required. Then the shape must be carefully studied. In a lamp-stand of a given height, care must be taken that the proportions harmonize with the size of the glass globe, which must not appear too large or too small. If the globe be large and the stand short, the latter must be of massive design, the ornamentation being of a similar character. If, however, the stand be high the ornamentation should be light and sparingly employed. We have seen lamp-stands wreathed with clusters of roses; nothing could be more inappropriate. Floral ornaments are not suitable, save under certain exceptionable circumstances, but forms suggested by the same might be used with advantage. Several of the commonest forms of ornament used in gilt picture-frames, such as the acanthus, are borrowed from those of plants, and can often be tastefully utilized in this manner where the original forms would be decidedly inappropriate. One of the principal difficulties with which the student has to contend is the absence of any defined laws of form. Whenever a writer has attempted to analyze the principles on which ornamental form is based, he invariably drifts into an elucidation of the various styles, very useful, no doubt, in its way, but leaving the reader still uninformed respecting the laws which govern form. Hence the student finds it easier to imitate or adopt ornamental forms already in existence than to create others, aided solely by his own taste and talent. A tolerably accurate knowledge of the laws and principles of style may be acquired with comparative ease; but to understand the laws of form, so far as they are known or have been defined, necessitates the possession of a certain amount of educated taste. In designing articles of furniture or of domestic use, the art-workman generally has the primary form ready to his hand. He is instructed to design a table of a certain size and shape. In this instance his task very

frequently resolves into one of pure ornamentation. He has to study less the actual form of the table than of the ornament to be employed; hence he is apt to overdo his work, and introduce unnecessary details, which occasionally have a tendency to heaviness. The Greek workman acted on a different principle. Instead of devoting his attention exclusively to the ornamentation, he carefully considered the shape of the table, and the manner in which it might be improved without impairing its utility. Here his instinctive knowledge of the laws of form, although not actually required, would prove of assistance. He had to prepare a table, say of oblong-shape, with four legs. He would find that practically the form of the legs would regulate the appearance of the table. If too thick it would appear dwarfish and heavy; if too thin it would be deficient in stability. The use of the ornament and curved lines would be necessarily limited, especially the former. Yet, with all these restrictions, the Greek workman could produce a table which, without the slightest particle of ornamentation, would possess an elegance of form as to immediately please the eye, the very simplicity of the design and exactness of the proportions constituting the secret of the charm. The modern untrained workman does not act on this principle. He sends the legs to a turner, who fashions them according to his own fancy, totally irrespective of the intended design. As specimens of the turner's art they may be admirable, yet when forming portions of the table, become positively unsightly, because of the want of harmony between their proportions and those of the other details. It is here that the modern system of division of labour, however economical in its industrial and commercial results, has so frequently proved injurious to the development of a fair knowledge of form. Yet there is no reason why this should be so. If the shape of the table were accurately defined before a tool were touched, the various parts might be executed by different workmen, as at present. In the manufacture of what is termed "art furniture" this is done, but it should be the rule and not the exception. The principles on which a table is constructed are almost the same as those which govern architecture, the laws of gravity and stability render the use of vertical lines indispensable; but these lines may be either straight or curved. If the former, they may differ in one respect from the columnar support of the roof of a building, namely, in its base being smaller than the capital. A person ignorant of the laws of form would feel perplexed were he asked why that which in the one case constituted a source of beauty became in the other the reverse. The columnar principle as applied to the production of a table extends no further than the employment of vertical lines. In designing, a far greater amount of freedom is allowed than in architecture. For instance, a leg may be curved to an extent which would be a positive deformity

in a column, yet which, as in the case of certain forms of console table, may possess a considerable degree of grace when otherwise employed. But there is a limit to the employment of the curve, beyond which it is unsightly. Even where it is used, care must be taken that it is not brought into abrupt and harsh contrast with perfectly straight lines. But suppose the table is supported by a single pillar, the shape of its upper surface being either round or oval. Here the principle of the column, as employed in architecture, must be strictly adhered to; for if the base be not broader and heavier than the capital, or that portion supporting the table, it will overturn with the least pressure. Here the law of form is influenced by the laws of gravity. Whatever may be the shape of the design, it must be in accordance with the laws of gravity, otherwise the table will be useless, save for the purposes of mere ornament. With the view of imparting an appearance of lightness to the base of pillar, it is generally made to rest on three projecting curved feet, the idea being borrowed evidently from the form of several articles in use among the ancient Greeks. Simple as is this contrivance, it has frequently imparted to the humble cottage table an elegance and appropriateness of appearance not to be found in many tables of a more pretentious character. In loo, and other tables of the same kind, the base generally has to be so extended as to have a somewhat cumbrous aspect; this is sought to be relieved by the introduction of ornamentation, often more profuse than judicious, which would be unwholly unnecessary were the laws of form better understood and complied with. There is no reason why a loo table should not always be as graceful as any other article of furniture, without sacrificing a particle of strength or steadiness. The introduction of a profusion of ornament is simply a clumsy device for concealing want of taste or ignorance of form. In some tables, the pillars of which were richly carved, the ornaments represent leaves, fruit and flowers. All this, although beautifully executed, was in bad taste and unnecessary. Conventional ornament borrowed from the same would have been better; but simplicity of form, with just a sufficiency of ornament to relieve it from coldness, would have been better still.

Mr. Plummer then proceeded to describe the rules to be followed in the construction of furniture, and afterwards to show the manner in which the ornamental details might be produced. Taking a rough sketch of an ivy leaf and afterwards of a primrose, he showed how the natural shapes of the same might become suggestive of others forms of a most graceful character. He illustrated this portion of his address by some specimens of wall papers designed by the late Owen Jones and other eminent designers. In conclusion, he offered his honorary services to any class which might be formed for the study of art as applied to ornamental purposes.

SECTION H.—MEDICAL SCIENCE.

A PRELIMINARY meeting of the Section was held at the Society's Rooms, April 4, 1879.

The following officers were elected:—Chairman: Dr. J. C. Cox. Secretaries: Dr. P. S. JONES, Dr. MACLAURIN. Members of Committee: Mr. ROBERTS, Dr. CLUNE, from last year; Mr. WRIGHT, Dr. FORTESCUE, newly elected.

Seven ordinary meetings of the Section were held, at which papers were read and many pathological specimens exhibited.

At a meeting on September 5th, a paper was read by Dr. F. N. MANNING, entitled "Ten Years' experience as Medical Superintendent of Gladesville Lunatic Asylum."

It was decided to recommend this paper for publication in the Royal Society's Transactions.

P. SYDNEY JONES.
H. N. MACLAURIN, M.D.

Ten Years at Gladesville.

By F. NORTON MANNING, M.D.

[Read before the Medical Section, 5 September, 1879.]

VARIOUS causes have heretofore, much to my regret, prevented me taking part in these professional gatherings, and coming now as other than a listener I must ask you to regard this paper as an apologetic offering for past absence, and as embodying some experience gained in a peculiar professional position, which it is little less than my duty to lay before you.

I entered on the duties of Medical Superintendent of the Hospital for the Insane at Gladesville early in October, 1868. I ceased to hold that office on August 31st, 1879, so that my incumbency of office extended over nearly eleven years. Excluding the three closing months of the year 1868, in which, owing to the pressing duties of a new office and the absence of formal records, I was unable to tabulate results, and the first eight months of the current year, for which the statistical returns have not yet been prepared, there remains ten clear years, from January 1st, 1869, to December 31st, 1878, for which the returns are available. Some of these I purpose laying before you. I am anxious not to weary you with a mere array of figures, but desire to pick out some of the main facts and results, and to accompany these with brief statements on some few of the experiences I have gained. In conclusion I will, with your permission, make some remarks on epilepsy as seen in an institution for the insane, and upon general paralysis,—a disease which is most interesting in its symptoms and most fatal in its results, and which, so far as my experience goes, is not fully known to and certainly not so readily recognized in its earlier stages by the profession at large as would seem to be desirable.

As a preliminary, it is necessary that I should state certain facts which render the statistics I have collected much less valuable and complete than they might otherwise be, and which will explain the gaps and peculiarities in the figures I am able to lay before you. Under a system which has had some advantages and not a few drawbacks, Gladesville has been, for the whole space of time covered by the figures, the main receiving hospital for the insane of the whole Colony, and with the limited space at command it has been necessary to pass on or transfer to the other institutions at Parramatta, Newcastle, Cooma, Cook's River, and Callan Park, a number of cases mainly chosen as belonging to the more chronic, quiet, and incurable types of insanity. These cases disappear from the Gladesville registers, under the headings "transferred," or "not improved," and are not further traced.

For the last two years, 1877 and 1878, the statistics of the whole of the institutions for the insane have been collected on a general plan, and I trust I may be able on some future occasion to present

to you the statistics of insanity for the whole Colony, free from the lapses and imperfections which now invalidate those collected at a single institution.

	M.	F.	Total	M.	F.	Total.
On December 31st, 1868, there were in the institution				428	236	664
During the ten years were admitted for the first time ...	1,632	893	2,525	1,942	1,136	3,078
Re-admitted	310	243	553			
Total under care				2,370	1,371	3,742
Discharged or removed—						
Recovered...	690	463	1,153			
Relieved	112	106	218			
Transferred	904	380	1,284			
Died	332	99	431			
				2,038	1,048	3,086
Remaining in hospital on December 31st, 1878 ...				332	324	656
Average daily number resident for ten years				307	262	569

It will be seen that the number remaining on December 31st, 1878, was nearly the same as on the same date in 1868, and we are left, therefore, to deal with the admissions without difficulty. The percentage of recoveries on these admissions was for the ten years:—Males, 35·03; females, 41·69; total, 37·39. The percentage of cases relieved was:—For males, 5·76; females, 8·50; total, 7·08. So that a total percentage of 44·47, or shortly 45 per cent., so far recovered as to be discharged either to their work in the world or to the care of friends. This result, which does not compare unfavourably with those in similar institutions in Great Britain and Ireland, scarcely does justice to the officers at Gladesville, since, owing to overcrowding and the rapid transfer of patients, cases in which hope of cure still existed and finally took place were transferred, and so are lost to the statistics of the hospital which they would have served to render more favourable. Taking the returns from all the public institutions for the insane, I find that the recovered and relieved cases formed a percentage on the admissions in 1876 of 54·94, in 1877 of 52·67, and in 1878 of 44·82. When the delicate nature of the brain structure is considered, and when it is remembered that there has been no selection of cases, that insanity due to structural brain disease and to epilepsy, and that congenial imbeciles and idiots, and old people in their dotage have all been received, I think you will agree with me that the result is as favourable as could be expected, especially as the appliances and buildings are not of the best, and are always grossly overcrowded.

The deaths (as I have said) during the ten years numbered 431, 332 being males and 99 females, or a percentage on the average number resident of 7·50.

I would particularly direct your attention to the difference in the percentage among the males and females. The male deaths give a percentage of 10·78, the females of 3·71 only. I find on examining the returns from British and other asylums that the death rate is almost invariably less among the women, and this is to be mainly accounted for by the fact that apoplexy and paralysis, the destructive forms of brain disease, epilepsy, and general paralysis, which go largely to swell the death rate, are much less common among women than men. These percentages, I may say in passing, compare favourably with the death rate in English asylums, which for the last nineteen years averaged 10·25.

The following tables, drawn according to the form adopted by the Medico-Psychological Association, for asylum use, gives the causes of death in the 431 causes.

Total for 10 years 1869 to 1878 inclusive.

Causes of Death.	Male.	Female.	Total.
Cerebral or Spinal Diseases.			
Apoplexy and paralysis	32	9	41
Epilepsy and convulsions	38	8	46
General paresis	60	7	67
Maniacal and melancholic exhaustion or decay	27	16	43
Inflammation and other diseases of brain, softening, tumours, &c.	53	4	57
Cancer of brain	3	1	4
Thoracic Disease.			
Inflammation of lungs, bronchi and pleuræ	29	8	37
Pulmonary consumption	21	12	33
Disease of heart and blood-vessels	17	3	20
Abdominal Disease.			
Disease of liver	2	5	7
Pyæmia	1	0	1
Obstruction of bowels	1	0	1
Disease of spleen	1	0	1
Typhoid fever	1	0	1
Inflammation and ulceration of stomach, intestines, and peritoneum	4	0	4
Dysentery and diarrhœa	15	10	25
Inflammation of bladder and prostrate	1	1	2
Albuminuria	1	2	3
Cancer	2	4	6
Erysipelas	6	1	7
General debility and old age	11	9	20
Accident	1	0	1
Suicide	3	0	3
Carbuncle	1	0	1
Grand total for ten years	331	100	431

You will see that general paralysis heads the list with a total of 67 cases. Next comes inflammation and other coarse diseases of the brain, softening, tumours, &c., with 57 cases; then epilepsy and convulsions, 46; maniacal and melancholic exhaustion, 43; apoplexy and paralysis, 41; inflammation of lungs, 37; pulmonary consumption, 33; dysentery and diarrhœa, 25; diseases of the heart and blood-vessels, and general debility and old age, each 20. None of the other causes, among which are erysipelas, cancer, and disease of the liver, reach two figures. As might be expected, cerebral and spinal disease was the cause of death in upwards of three-fifths of the total number of cases, and thoracic disease is responsible for upwards of another fifth.

Pneumonia is a less common cause of death in the institutions for the insane in New South Wales than in those of the Mother Country, but it is very insidious and not unfrequently makes some headway before the patient is noticed to be ailing. It attacks as a rule the more demented cases, who make no complaint of pain, and who often have no cough, so that the symptom first noticed is loss of appetite. The thermometer is most useful in demented patients for the purpose of detecting the presence of serious disease, and where the temperature is high the chest should at once be examined.

Phthisis pulmonalis is as a rule a particularly lingering disease in an asylum. The insanity accompanying and sometimes caused by phthisis has occasionally been classified as a distinct form of the affection. It is as a rule characterized by delusions of suspicion and fear, the many aches and pains to which phthisical subjects are liable being attributed to poison, and the patients irritable and often violent in consequence.

The mental condition it might be imagined would aggravate and accelerate the physical disease, but such is not the case. Phthisis as seen in asylum practice is as a rule a decidedly chronic affection.

In three cases you will notice that death was due to suicide. In one the patient had been an inmate for seven years and had never displayed the slightest suicidal tendency. The case is interesting on this account, as showing that in insanity with defective reasoning power and weakened mental balance suicide may occur in any case where least expected. This patient often asked to be made an attendant, and I was never able to assign any reason for his act beyond a pang of disappointment because I appointed a new attendant, and neglected his imaginary claims. My experience has taught me to believe that a very large number of the insane, even among the more imbecile class, may at any moment and from trivial causes attempt their own lives.

In the second case a patient undid a complex bandage with which his arm was fastened to his side, and spite of a fractured clavicle committed suicide by hanging.

The third case was the most desperate case of self-destruction I ever remember to have seen or heard of. The patient, left alone for a few minutes, made a wound through the skin of the neck with the sharp edge of a stud, forced his forefinger into the wound and tore the blood-vessels of the neck until he caused hemorrhage which resulted in death; the whole injury was the work of five or six minutes. Both my colleague and myself were with him within six minutes of the time when he had been seen and spoken to by an attendant, and though we did everything possible to arrest hemorrhage he died in about half-an-hour. The condition of matters found at the *post mortem* examination noted by my colleague, Dr. T. M. Joseph, was as follows :—" The wound was situated 1½ inch above the clavicle, 1½ inch from the median line and directly over line of the carotid. It was irregular in shape, would admit the index finger, and extended from the surface directly down upon the carotid and along that vessel down to the clavicle. Only a limited examination was permitted. The vertebral artery arose from the carotid about ½-an-inch from the aortic arch. The carotid was absolutely and cleanly dissected from its sheath. No wound could be found in the vessel which was distended, and when cut across gas escaped from it, showing that it could not have been wounded. The internal jugular vein and pneumo-gastric nerve were apparently uninjured, and the great hemorrhage appeared to have come from the inferior thyroid artery, the most important branch of the axis."

The insensibility to pain exhibited in this case is not infrequent in states of great mental exaltation or distress. Shortly before I took charge of Gladesville a patient slit up his scrotum and removed a testicle by means of a scrap of glass. One patient was admitted under my care shortly after acting literally on the biblical command, " If thy right hand offend thee, cut it off," and choosing a by no means sharp instrument for the purpose; and I well remember one woman in a state of acute mental distress tearing out in one short night every scrap of a particularly abundant head of hair, and presenting herself in the morning somewhat calmer but absolutely bald; and this leads me to one remark as to treatment, which is, that the dose must be apportioned to the severity of the malady, and that it is through fear of full and sufficient doses of sedatives, given at the time that sedatives are most useful, that mental maladies often pass on to a confirmed stage. In melancholia, the form in which sedatives are best borne and most useful, I find it best to give full doses, and I consider 2 drachms of tincture of opium as a by no means extreme dose. I commence with ½ a drachm, and I have given ½ an ounce three times daily.

A question of considerable interest is the proportion of insane persons to the general population, and because a mistaken idea on this point is widely prevalent in this Colony, and because no persons have such abundant opportunities of correcting erroneous impressions as medical men, I think it advisable to place the figures before you. It is generally supposed that the number of insane persons here is unduly large. You will see that it is slightly below that in Great Britain and Ireland and in two of the Australian Colonies. On December 31st, 1877—and I take this date as the latest for which I have the figures complete—the proportion was as follows :—

In England	1 in 368	Great Britain and Ireland, 1 in 355.
Scotland	1 ,, 411	
Ireland	1 ,, 283	
New South Wales ...	1 ,, 362	Australian Colonies, 1 in 356.
Tasmania	1 ,, 317	
Victoria	1 ,, 313	
South Australia ...	1 ,, 491	
Queensland	1 ,, 487	
Western Australia ...	1 ,, 419	

So far as I have been able to learn, the proportion of insane persons to population is nearly the same in civilized communities all the world over. Wherever the statistics are accurately kept, the proportion appears to be 1 in from 350 to 400 of the general population.

South Australia, Queensland, and Western Australia, being comparatively young Colonies, have not yet obtained by accumulation their full proportion.

The proportion in New South Wales is now only very slowly increasing. In the year 1868 it was 1 in 379; in 1878 1 in 362. It has taken ten years to rise from a proportion of 2·63 to 2·76 per thousand. The rapid increase in the population, which in 1878 amounted to 35,000, and in the first six months of the present year to 18,000, brings an increase in the number of patients to the amount of about 90 or 100 annually, and for these accommodation, attendance, and maintenance have to be provided.

Epilepsy as seen in an institution for the insane is a disease of considerable interest and great frequency. It was found to exist on admission in 208 patients (143 males and 65 females) out of the total number, 3,078 (1,942 males and 1,136 females) admitted, and as will be seen was less common among the female than the male patients. In a number of the cases epilepsy was the cause of the insanity, but in others was only a concurrent disease or symptom. Besides the cases in which it existed on admission, it was developed in the progress of a number of cases, particularly of chronic brain

disease, after admission, and caused death in twenty of these. The following figures show the disposal of the 208 patients who suffered from it on admission.

	Male.	Female.	Total.
Recovered	24	11	35
Relieved	8	4	12
Transferred	75	35	110
Died	20	6	26
Remaining	16	9	25
	143	65	208

In stating that thirty-five recovered, I desire particularly to point out that the recovery was from the insanity and not from the epilepsy. The recoveries from epilepsy I can count upon my fingers; and in the majority of these the disease was of short standing and due to intemperance. In one case the disease, which had existed for some years, disappeared after an operation for phymosis; and in two cases of well-marked epilepsy of long duration occurring in children, the recovery was complete under the prolonged administration of bromide of potassium. There is a third case now in the hospital which promises to terminate in the same satisfactory way.

The subject of epilepsy, as it is seen in asylums, would of itself furnish a text for a lengthy paper, and as I desire to make these notes as practically useful as possible, I will only stop to give a few hints on treatment suggested by experience. If cure cannot be expected, relief is of importance; and I am inclined to think that every paroxysm spared the patient is a gain. Attention to diet does much to ward off and lessen the frequency of the fits. A farinaceous diet is frequently useful, and I often for many months together give minced meat to these patients with an excellent effect. Purgatives are almost always necessary; and sulphate of magnesia in doses of twenty grains to one drachm three times a day, with belladonna in from five to ten minim doses, is I think the best form. The bromide of potassium is most useful. It most assuredly diminishes the frequency without adding to the force of the fits, and in many cases renders patients who, on admission, suffered from frequent fits accompanied by maniacal excitement, extremely quiet and manageable. It not only reduces the number of the fits, but it subdues and often completely clears away the mental excitement accompanying them. It is a medicine, however, which it is useless to play with. It must be given steadily, persistently, and in large doses. I have found the *Cannabis indica* a very useful adjunct in this as in all other convulsive affections, and the formula which at this

time is most in use at Gladesville for epilepsy is ½-drachm doses each of bromide of potassium, tincture of cannabis, and sulphate of magnesia, an extremely nauseous compound, but one which an epileptic seldom or never refuses to take, as this class of patient as a rule take medicine with avidity. The recumbent position, and a dimly lighted room for a few hours, or even a day or two, after a fit, will often ward off an attack of mental excitement, and a dose of chloral hydrate is useful in the same direction.

One of the most interesting diseases seen in a hospital for the insane is general paralysis or paresis. The paralysie générale des alienes of French writers, which has only been recognized as a distinct affection since the year 1839, when Dr. Rainy, of the United States, and Dr. W. F. Browne, then of the Crichton Institution at Dumfries, and now a retired Commissioner in Lunacy for Scotland, contemporaneously described it as possessing special features. In 1842, Dr. Bell, of the McLean Asylum at Boston, wrote of it as a new disease in America, and stated that his registers prior to that date contained no cases resembling it in their manifestations, though it has probably existed unrecognized in England. Dr. Browne, in a letter written to me about two years ago, states that it was at the time he first described it, a rare, if not a new form of mental affection in Scotland, and says, "I industriously sought for any proof of its existence in former records, and have been forced to regard it as an outcome of modern manners and modes of life." It is curious that it remains to this day a somewhat rare affection in Scotland, in Ireland (especially in the northern districts) and also in the United States; though it is far from being so in England, on the Continent of Europe, or as we shall presently see, in this Colony. The evidence as to its comparative rarity in Scotland, the north of Ireland and America, is indisputable. The late Dr. Robert Stewart, of the Belfast Asylum, never saw a case in that institution during a service of forty years, and his son, Dr. James Stewart, stated at a meeting of the Medico-psychological Association held in 1875, that his father, reading so much of the disease as it existed in England, and unable to recognize it, and feeling it a sort of unexpressed reproach that he was unable to diagnose it, went expressly to England, saw it in English Asylums, and returning home asserted positively that the disease did not exist in the institution over which he presided. In 1868, after seeing the disease in English and continental asylums, I made inquiries on the subject in the United States, and found that instances of it were rare. "I have not a single case," said the superintendent of a large asylum in the Eastern States, "and the last patient who suffered from it here was an Englishman." In 1875 I spent a day with Dr. Shurtcliffe, at the Stockton Asylum, California,

who, in answer to my inquiries, said, "I am not sure that I know general paralysis; come and see if you can find it in my wards." At this time I had no inconsiderable experience of the disease, and yet was unable to discover a case among 800 male patients, though the cases of partial paralysis, softening from brain disease, aphasia, &c., were all shown to me specially, and I had full opportunity of searching for myself. Theories have been started that certain races are less subject to this affection than others, and that persons of Celtic extraction are almost exempt. I am afraid that further experience will be fatal to such fancies. I have admitted to Gladesville, 52 general paralytics of English, 23 of Irish, 12 of Scotch, 4 of German, and 3 of French nationality, besides 12 New South Welshmen, 3 citizens of the United States, 2 Dutchmen, a West Indian, a Swede, and a Tasmanian. I have, however, never seen the disease in a Chinaman, an aboriginal Australian, or a South Sea Islander. An ingenious Irishman, Dr. Ashe, in an elaborate paper published about four years ago, attributes the disease entirely to beer and to the *cocculus indicus* with which beer is adulterated, and attributes the comparative immunity of Irish and Scotchmen when at home to the fact that whisky is their usual potation. There is something perhaps to be said for this view, but the verdict must as yet be "not proven." The causes to which the cases admitted to Gladesville have been attributed are many and various, and include both physical and moral agencies. They afford no ground for dogmatizing, and some, such as intemperance and excessive sexual indulgence, though possible causes in some cases, were in others clearly symptoms. It is a curious fact with reference to intemperance in drink in this relation, that in two of the best marked cases now in Gladesville the patients are, and have been for years, absolute and persistent teetotalers. The complex cause which appears to me to have been most potent, should sum up in the two words *high pressure*—life under the stress of modern competition and hurry, the haste to get rich, the habit of over-work, the abominable practice of keeping up steam by stimulants. Put into a scientific formula, the cause of the disease may be described as "abusive functional activity of the brain" an unwise expenditure of brain power, with possibly some peculiar diathetic basis. During the past ten years 114 cases of general paralysis have been admitted to Gladesville, 101 being males and 13 females; and here let me parenthetically remark that it appears to be a peculiarity of the disease, wherever known, that it affects the male sex in a much greater proportion than the female. Of the total cases admitted 58 died, 5 remained at the close of 1878, and the remainder, 56 in number, were transferred to Parramatta. 16 of these died during the 1877–8 in that institution.

In addition to these numbers 15 other cases admitted prior to 1868 have died, making a total of 67 deaths in ten years. This

disease being therefore accountable for nearly $\frac{1}{4}$ of the total death-rate among the male, and about $\frac{1}{14}$ of the deaths among the female patients.

I am unable to point to a single instance of recovery, though in not a few instances there has been for a time such an arrest in the progress of the disease under treatment as to call forth strong hopes of a better result. In three or four instances the arrest and indeed the improvement was so marked that, yielding to the entreaties of friends whose unpractised eyes failed to see that the disease had not disappeared, I discharged the patients to their care, with a result which I anticipated,—their return in a longer or shorter period to hospital. In one case I was hopeful that recovery had really taken place, but the hope was not realized.

On searching the records of Psychological Medicine and comparing notes with other workers in the same field, I am unable to discover that anyone has been really more successful than myself. I am unaware of an instance of recovery in a well marked case of this peculiar affection. I am, however, far from believing that the disease is in its early stages completely and thoroughly intractable and incurable. The improvement which I have noticed in well marked cases under treatment renders it to my mind probable that the disease in its beginning is amenable to medical treatment, and it is with this feeling that I am particularly commending it to your attention. It is in private practice and not in special institutions that its beginnings are to be seen. Unfortunately the march of the disease is so insidious, there is such a strange mixture of sanity with mental aberration, some of the faculties remain so bright, are even brighter than aforetime, the memory is in most instances so perfect, and the patient when at all on his guard is so capable of concealing his erratic fancies, that neither friends nor physician realize the extent of the mischief. In very many instances the physician is not consulted until the symptoms of insanity are all too patent, and the patient wrapped up in his roseate fancies, scorns the idea of illness and rejects all advice. And yet I think in many cases the disease might be recognized earlier than it is. Once being called on other business into a Court of Justice, I saw a poor fellow standing in the dock in whom I recognized almost at a glance the well-marked symptoms of general paralysis. He had stolen some article in the full belief of ownership; and not long since a man was sent to my care after degradation and punishment in the Public Service for actions committed whilst really insane. Both these cases had been under medical observation without any recognition of the disease in its early stages. I may here remark that general paralysis appear as a rule to attack persons between their 30th and 45th year, and that the cases occurring before or after these times are few. Among my cases at Gladesville, the youngest was 26, and the oldest 52, but

only five cases were under 30, and only one above 50. I will with your permission point out some of the early or premonitory symptoms, and then sketch briefly from my own experience those which characterize the three stages into which this affection in its procession is divided.

Among the premonitory symptoms are restlessness and unnatural excitement, a tendency to over-work, to over-drink and to strain to the utmost the physical and mental power ; with this there is an irritability of temper, an impatience of all control or advice, an exaggerated sense of personal importance, and a proneness to indulge in business speculations and ventures totally foreign to all former custom. The first stage of the disease is not unfrequently ushered in by an attack of acute mania of longer or shorter duration, but quite as frequently the progress is more gradual, delusions of a more or less grandiose character make their appearance, and there is a tendency to appropriate articles under a mistaken idea of ownership, or to rush into lavish expenditure from a belief in the possession of untold wealth. The delusions vary extremely, but they have one character in common — they are all extravagant and hyperbolic. The patient imagines himself wealthy ; he holds interviews with the Almighty, or with kings and persons in high position ; he speaks boastfully of his mental powers, and no undertaking is too great for his capabilities. He has a large idea of his physical perfections, and this often brings accident and trouble owing to attempts to escape in the face of all obstacles or of gymnastic feats worthy of Blondin or Leotard. The same idea, combined with an imaginary self-importance, prompts him, though a pigmy in stature, to engage in combat with fellow-patients, and to resent by blows any slight to his dignity. He describes his children as physically and mentally perfect, and though they number a dozen, will often wish for more. With this there is occasional incoherence, owing to over-rapidity of ideation rather than want of consecutive thought, and a marked restlessness and hurry. The following physical symptoms commence in this stage and increase in the second stage of the disease :—Tremor of the facial muscles, the tongue and hands, a marked peculiarity of speech which is not unlike—but to a practised ear can easily be distinguished from—the slur and clip of intoxication, a rapid pulse, some rise of temperature, an inequality of the pupils— one generally being much larger than the other, but not inactive—and emaciation. The second stage is characterized by extreme placidity, an unnatural contentment with every surrounding, a mental atmosphere of sunshine and rose colour : the delusions are grander than ever, but have a much less influence on conduct, there is evident intellectual failure, and a tendency to make flesh sometimes to a surprising degree. The paralytic symptoms increase, the gait becomes markedly affected and uncertain, and the speech very defective.

The third stage is one of dementia, mind and body alike succumbing to paralysis. There is increasing mental hebetude and gradual impairment of motive power, defective sphincters, bed sores, and then death.

In many, indeed in most cases, at some period of the disease, and generally the second stage, epileptiform fits make their appearance, and occurring at somewhat distant intervals leave a transient hemiphegia and an increase of mental weakness. Sometimes death takes place in one of these. The stages vary much in length, are sometimes indistinct, and in some cases are run through with great rapidity, but the average duration of the disease is from eighteen months to two years. Men die frequently from what may be called accidents or secondary illnesses in the course of the disease. In women, owing partly to urinary troubles being less marked, partly to the more skilful nursing which always obtains in the female division of a hospital for the insane, and partly to a greater freedom from the epileptiform attacks, the disease usually runs a longer course, and occasionally reaches into the fourth or even fifth year, but seldom or never beyond this.

I do not propose to enter at any length into the pathology of general paralysis. All recent investigation tends to show that it is primarily a disease of the grey matter of the brain. A chronic inflammation of the outer layer of the convolutions, particularly in the frontal and parietal regions, and that the pia mater covering these is always more or less affected.

The pathological appearances differ, as I need hardly state, in different stages of the disease, but in all they point to chronic inflammation, and those noted when death occurs in the latest stages are quite as corroborative of the inflammatory character of the affection as those seen when it is cut short in its career. Briefly stated, these are—thickening and increased density of the skull, thickening and discolouration of the dura mater, with evidences of a past meningitis, great opacity and thickening of the arachnoid over the upper and front aspects of the cerebrum, and in a much less degree over the occipital portions; thickening and œdema of the pia mater, which becomes coarse and tenacious, and in 80 per cent. of the cases is found to be strongly adherent to the grey matter in the frontal regions, from which indeed it is separated only with difficulty, and with the result of leaving a rough eroded surface, a wasting or atrophy of the frontal and parietal lobes with much œdematous effusion. On cutting into the grey matter it has a faded and shallow appearance, and is traversed by large, coarse, and prominent vessels. The large vessels are, as a rule, free from atheromatous or calcareous deposit, the ventricles are abnormally capacious and full of fluid, and the basal ganglia all more or less atrophied. Of the microscopical

changes I cannot speak from personal observation, but from the researches of Dr. Gray, of Utica, New York, and Dr. Batty Tuke, of Glasgow, the main changes appear to be shrinking and disorganization of the nerve cells and thickening of vascular walls, with increased development of the neuroglia or connective tissue, which goes on progressing at the expense of the nerve elements. The pathological appearances all point to the importance of hyperæmia in the origination of the series of changes in which the disease consists, but it is not improbable, as shown by the researches of German observers, that the nervous system—the brain cells—are the true fountain and source of the malady, and that the greater facility with which morbid changes in cerebral membranes, blood-vessels, and connective tissue can be made out has conduced to a magnification of their share in this and other brain diseases. With regard to treatment, iodide and bromide of potassium have appeared to me to be beneficial in some cases, and combined with digitalis might I think be extremely useful when the premonitory symptoms only have appeared. Bin-iodide of mercury and Calabar bean have been favourably reported of, and Dr. McLeod, of the Yarmouth Hospital, is enthusiastic in the praise of counter-irritation to the scalp by means of blisters, croton oil, &c.,—a means of treatment I have tried and found very serviceable in several forms of insanity with meningeal symptoms. The remedy in which I have most faith in the first stage of the disease (as serving to arrest its progress) is digitalis, of which I give full doses with iron, and I think I have seen some good from ergot in later stages. A copious and nutritive diet is most necessary. The excitement in the earlier stages is a great drain on vital power, and unless the patient is well fed and receives stimulants, of which the best form seems to be beer, he will sink in this stage from exhaustion. The quantity of food taken by some general paralytics, with benefit, is enormous. I mention the question of feeding especially, as I have found that some patients before admission have been kept on a very restricted diet.

SECTION I.—SANITARY SCIENCE.

Report of the Sanitary Section of the Royal Society for the Session 1879.

To the President of the Royal Society of N.S.W.

Sir,

I have the honor to submit the following report:—

The first meeting of the session was held on the 22nd September last, when Mr. Alfred Roberts was elected Chairman, and the following gentlemen were elected a Committee, namely:—Mr. Alfred Roberts, Dr. Belgrave, Dr. Jackson, Mr. Norman Selfe, and Mr. W. A. Dixon; Mr. Harrie Wood was chosen as Honorary Secretary.

At the same meeting Mr. Norman Selfe read a very interesting paper on the subject of the value of High Pressure in Water Supply; and the subject of an alteration of the terms employed in the Medical Certificate of Death used by the Registrar General in connection with the Vital Statistics of the Colony was further considered, and it was resolved that an alteration be submitted to the Colonial Secretary.

A subsequent meeting was held for the further consideration of Mr. Selfe's paper, and some valuable information on the subject was supplied by Mr. Trevor Jones. The result of the deliberation of the Section, affirming the advantage of high pressure, was communicated to the Council of the Society.

During the session the Committee held only one meeting.

I have, &c.,

ALFRED ROBERTS,

Chairman.

APPENDIX.

ABSTRACT OF THE METEOROLOGICAL OBSERVATIONS TAKEN AT THE SYDNEY OBSERVATORY.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

JANUARY, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·036 inches on the 14th at 11 p.m.
	Lowest Reading	29·479 inches on the 22nd at 4·25 p.m.
	Mean Height	29·769 inches.

(Being the same as that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	140·0 lbs. on the 30th.
	Mean Pressure	1·0
	Number of Days Calm ...	0
	Prevailing Direction ...	E.N.E.

(Prevailing direction during the same month for the preceding 20 years, N.E.)

Temperature	Highest in the Shade ...	85·7 on the 29th.
	Lowest in the Shade ...	57·2 on the 14th.
	Greatest Range	19·1 on the 29th.
	Highest in the Sun ...	143·3 on the 5th.
	Lowest on the Grass ...	50·1 on the 13th and 14th.
	Mean Diurnal Range ...	11·6
	Mean in the Shade ...	71·9

(Being 0·6 greater than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	100·0 on the 20th at 9 p.m.
	Least	43·0 on the 13th at 3 p.m.
	Mean	72·9

(Being 0·3 greater than that of the same month on an average of the preceding 20 years.)

Rain	Greatest Fall	1·562 inches on the 21st.
	Number of Days	10 rain and 1 dew.
	Total Fall	2·250 inches. 65 feet above ground. 3·144 inches. 15 in. above ground.

(Being 0·500 inch less than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	6·967 inches.
Ozone ...	Mean Amount	7·4

(Being 2·7 greater than that in the same month on an average of the preceding 19 years.)

Electricity ...	Number of Days Lightning	5
Cloudy Sky	Mean Amount	5·2
	Number of Clear Days ...	0
Meteors ...	Number observed	0

Remarks.

The weather this month has been warm, but without very hot days. On the coast districts there has been a fair rainfall, but inland the fall has been generally very light, and in some few places nothing, so that the dry weather inland is beginning to be serious. "Wentworth" hurricane on the 10th, very severe south of Fiji.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

FEBRUARY, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·067 inches on the 24th at 10 p.m.
	Lowest Reading	29·383 inches on the 20th at 3·14 a.m.
	Mean Height	29·751 inches.

(Being 0·054 inch less than that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	9·2 lbs. on the 16th.
	Mean Pressure	1·0
	Nunber of Days Calm ...	0
	Prevailing Direction ...	N.E.

(Prevailing direction during the same month for the preceding 20 years, S.)

Temperature	Highest in the Shade ...	87·7 on the 27th.
	Lowest in the Shade ...	58·2 on the 24th.
	Greatest Range	19·6 on the 27th.
	Highest in the Sun ...	145·4 on the 27th.
	Lowest on the Grass ...	48·8 on the 4th.
	Mean Diurnal Range ...	11·5
	Mean in the Shade ...	70·6

(Being 0·2 less than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	98·0 on the 10th at 9 a.m.
	Least	30·0 on the 21st at 3 p.m.
	Mean	70·1

(Being 4·8 less than that of the same month on an average of the preceding 20 years.)

Rain ...	Greatest Fall	2·265 inches on the 16th.
	Number of Days	13
	Total Fall	2·378 inches. 65 feet above ground. 3·689 inches. 15 in. above ground.

(Being 3·074 inches less than that in the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	4·997
Ozone ...	Mean Amount	7·3

(Being 2·4 greater than that in the same month on an average of the preceding 19 years.)

Electricity...	Number of Days Lightning	2
Cloudy Sky	Mean Amount	6·0
	Number of Clear Days ...	1
Meteors ...	Number observed	0

Remarks.

The mean temperature this month has only been 1·3 less than that for January, and the hottest day was two degrees hotter than any day last month.

Excepting the south-west portion of the Colony the rains have been moderate to heavy; the heaviest rainfall recorded is 14 inches at Bodalla. Generally in the Liverpool Plains and New England Districts very heavy rains have fallen. At Cooma on the 15th after a very heavy thunderstorm, the largest flood known there for six years came down; the water was two feet deep in the houses in the lower part of the town. The drought felt in the south-west portion of this Colony extends over the Colony of Victoria, and it is asserted that in parts of that Colony no rain has fallen for five months, and bush fires are doing much damage.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

MARCH, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·235 inches on the 22nd at 9 a.m.
	Lowest Reading	29·476 inches on the 14th at 3 a.m.
	Mean Height	29·868 inches.

(Being 0·028 inch less than that in the same month on an average of the preceding 20 years.)

Wind	Greatest Pressure	11·0 lbs. on the 25th at 9·20 p.m.
	Mean Pressure	0·5 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	N.E.

(Prevailing direction during the same month for the preceding 20 years, N.E.)

Temperature	Highest in the Shade ...	88·7 on the 25th.
	Lowest in the Shade ...	55·9 on the 19th.
	Greatest Range	29·4 on the 25th.
	Highest in the Sun ...	140·1 on the 25th.
	Lowest on the Grass ...	50·8 on the 19th.
	Mean Diurnal Range ...	10·8
	Mean in the Shade ...	67·6

(Being 1·8 less than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	99·0 on the 5th at 9 p.m.
	Least	35·0 on the 25th at 3 p.m.
	Mean	75·0

(Being 1·6 less than that of the same month on an average of the preceding 20 years.)

Rain	Greatest Fall	0·930 inches on the 5th.
	Number of Days	13 rain and 3 dew.
	Total Fall	2·042 inches. 65 ft. above ground. 2·672 inches. 15 in. above ground.

(Being 2·641 inches less than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	3·604 inches.
Ozone	Mean Amount	6·8

(Being 1·7 greater than that in the same month on an average of the preceding 19 years.)

Electricity ...	Number of Days Lightning	1
Cloudy Sky	Mean Amount	6·6
	Number of Clear Days ...	0
Meteors ...	Number observed	1

Remarks.

The temperature has been 1·8 below the average, yet on the 25th it rose to 88·7, the highest this year so far. The rains have been heavy in the Northern and Southern districts, but inland it has been light. On the 17th the river at Bingera was in a state of high flood, and a bridge at Myall Creek was carried away. Several new Stations will be found on this list, the returns being kindly sent by the proprietors of the properties named. High flood at Bingera, March 17th; flood at Inverell same date.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

APRIL, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·365 inches on the 16th at 9 a.m.
	Lowest Reading	29·612 „ on the 1st at 5 p.m.
	Mean Height	30·016 „

(Being 0·001 inch greater than that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	15·7 lbs. on the 11th.
	Mean Pressure	0·6 lb.
	Number of Days Calm ...	1
	Prevailing Direction ...	S.

(Prevailing direction during the same month for the preceding 20 years, W.)

Temperature	Highest in the Shade ...	80·4 on the 1st.
	Lowest in the Shade ...	46·9 on the 14th.
	Greatest Range	18·9 on the 14th.
	Highest in the Sun ...	135·5 on the 1st.
	Lowest on the Grass ..	42·6 on the 14th.
	Mean Diurnal Range ...	12·0
	Mean in the Shade ...	62·2

(Being 2·9 less than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount ...	97·0 on the 15th at 9 a.m.
	Least	51·0 on the 13th at 9 a.m.
	Mean	77·4

(Being 0·1 less than that of the same month on an average of the preceding 20 years.)

Rain ...	Greatest Fall	0·415 inches on the 10th.
	Number of Days	10 rain and 8 dew.
	Total Fall	1·106 inches. 65 feet above ground. 1·860 „ 15 in. above ground.

(Being 5·070 inches less than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	2·408 inches.
Ozone ...	Mean Amount	7·7

(Being 2·5 greater than that in the same month on an average of the preceding 19 years.)

Electricity...	Number of Days Lightning	1
Cloudy Sky	Mean Amount	4·9
	Number of Clear Days ...	1
Meteors ...	Number observed	1

Remarks.

The depression in temperature is maintained, the mean for this month being 2·9 below the average. and lower than that of any other April except 1872, when the mean was 62·1. In the Northern districts the rain has been heavy during the month, the maximum fall being at Clarence River Heads, 11·22 inches. Generally the fall has been sufficient for the time of year, except in the Southern districts, where the fall was rather small.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

MAY, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·091 inches on the 9th at 12·20 a.m.
	Lowest Reading	29·274 inches on the 29th at 4·10 a.m.
	Mean Height	29·707 inches.

(Being 0·216 inch less than that in the same month on an average of the preceding 20 years.)

Wind	Greatest Pressure	25·2 lbs. on the 15th at 9·43 p.m.
	Mean Pressure	0·9
	Number of Days Calm ...	0
	Prevailing Direction... ...	W.

(Prevailing direction during the same month for the preceding 20 years, W.)

Temperature	Highest in the Shade ...	66·8 on the 21st and 22nd.
	Lowest in the Shade... ...	45·5 on the 29th.
	Greatest Range	15·7 on the 19th.
	Highest in the Sun	126·2 on the 2nd.
	Lowest on the Grass... ...	40·0 on the 27th.
	Mean Diurnal Range ...	11·2
	Mean in the Shade	56·7

(Being 1·8 less than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	100·0 on the 11th at 9 a.m.
	Least	52·0 on the 23rd at 3 p.m.
	Mean	80·1

(Being 3·9 greater than that of the same month on an average of the preceding 20 years.)

Rain	Greatest Fall	3·340 inches on the 16th.
	Number of Days	22 rain and 7 dew.
	Total Fall	9·344 inches. 65 feet above ground. 12·115 inches. 15 in. above ground.

(Being 6·974 inches greater than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	1·604 inches.
Ozone	Mean Amount	7·8

(Being 2·8 greater than that in the same month on an average of the preceding 19 years.)

Electricity...	Number of Days Lightning	8
Cloudy Sky	Mean Amount	6·2
	Number of Clear Days ...	0
Meteors ...	Number observed	1

Remarks.

The temperature this month is again below the average 1·8, and on 29th it fell to 45·5. At Sydney the rainfall has been nearly 7 inches above the average—and generally the rainfall this month has been abundant on the coast, reaching a maximum of 17 inches at Port Macquarie. In the southern parts of Riverina the total fall at many places was less than 2 inches. Heavy S.E. gale on the coast of Queensland about 7th; flood at Grafton on 26th; flood at Lismore May 12th.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

JUNE, 1879.—GENERAL ABSTRACT.

Barometer ...	Highest Reading	30·276 inches on the 20th at 10 a.m.
At 32° Faht.	Lowest Reading...	29·520 inches on the 15th at 3·45 p.m.
	Mean Height	29·927 inches

(Being 0·002 inch greater than that in the same month on an average of the preceding 20 years.)

Wind	Greatest Pressure	16·2 lbs. on the 15th at 8·50 p.m.
	Mean Pressure	0·8 lb.
	Number of Days Calm ...	0
	Prevailing Direction... ...	W.

(Prevailing direction during the same month for the preceding 20 years, W.)

Temperature	Highest in the Shade ...	62·1 on the 12th and 26th.
	Lowest in the Shade... ...	41·2 on the 8th.
	Greatest Range	17·5 on the 12th.
	Highest in the Sun	119·2 on the 3rd.
	Lowest on the Grass... ...	33·0
	Mean Diurnal Range... ...	12·1
	Mean in the Shade	52·2

(Being 2·4 less than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	100·0 on the 23rd at 9 a.m.
	Least	51·0 on the 12th at 3 p.m.
	Mean	77·2

(Being 0·4 greater than that of the same month on an average of the preceding 20 years.)

Rain	Greatest Fall	1·230 inches on the 4th.
	Number of Days	14 rain and 14 dew.
	Total Fall	4·376 inches. 65 ft. above ground. 5·898 inches. 15 in. above ground.

(Being 0·297 greater than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	1·457 inches.
Ozone	Mean Amount	7·1

(Being 1·6 greater than that in the same month on an average of the preceding 20 years.)

Electricity...	Number of Days Lightning	1
Cloudy Sky...	Mean Amount	4·1
	Number of Clear Days ...	2
Meteors ...	Number observed	0

Remarks.

This month the temperature is again low, being 2·4 less than the average for the month. South-east gale 23rd and 24th. Inland the rainfall this month has been generally under one inch, but on the coast from Sydney northwards the fall has been abundant, especially at and about Sydney, Gosford, Port Macquarie, Grafton, and the highland, thence northward to the boundary. The maximum fall was 7·65 inches at Watson's Bay, and the minimum at 0·20 inch at Tamworth, and 0·21 at Urana. On the 5th 4 inches of snow fell at Orange; on 29th weather very cold, something like snow falling at the Observatory, Sydney, but proved to be drops of water very small; snow-flakes said to have fallen at North Shore; 20th, Macleay River in flood, 20 feet above usual level.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

JULY, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·396 inches on the 13th at 10 a.m.
	Lowest Reading	29·460 inches.
	Mean Height	29·938 inches.

(Being 0·002 inch less than that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	9·7 lbs. on the 7th.
	Mean Pressure	0·8 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	W.N.W.

(Prevailing direction during the same month for the preceding 20 years, W.N.W. and W.)

Temperature	Highest in the Shade ...	62·6 on the 31st.
	Lowest in the Shade ...	40·6 on the 5th.
	Greatest Range	19·3 on the 5th.
	Highest in the Sun ...	114·2 on the 9th.
	Lowest on the Grass ...	33·5 on the 23rd.
	Mean Diurnal Range ...	12·0
	Mean in the Shade ...	51·5

(Being 1·0 greater than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	99·0 on the 24th at 9 a.m.
	Least	46·0 on the 7th at 3 p.m.
	Mean	79·0

(Being 4·2 greater than that of the same month on an average of the preceding 20 years.)

Rain	Greatest Fall	0·278 inches on the 1st.
	Number of Days	13 rain and 9 dew.
	Total Fall	0·609 inch. 65 feet above ground. 1·253 inches. 15 in. above ground.

(Being 3·348 inches less than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	1·585 inches.
Ozone ...	Mean Amount	7·9

(Being 2·5 greater than that in the same month on an average of the preceding 20 years.)

Electricity...	Number of Days Lightning	3
Cloudy Sky ..	Mean Amount	5·4
	Number of Clear Days ...	0
Meteors ...	Number observed	0

Remarks.

The first month this year in which the temperature has been above the average. The rainfall is also remarkable, being 3·348 in. less than the average. Heavy westerly gale on the 7th. In the northern districts the rainfall has been heavy, and in the early part of the month the rivers were flooded. On the 10th there was a general fall of snow along the mountains. About Armidale it is said to have been the heaviest fall for the past sixteen years, the ground was covered 8 or 9 inches deep. The temperature has been low generally, and at times the cold was unusually severe. On 10th heavy fall of snow at Carcoar, Blayney, and Armidale.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

AUGUST, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·300 inches on the 19th, at 10 a.m.
	Lowest Reading	29·420 „ on the 7th, at 6 a.m.
	Mean Height	29·917

(Being 0·026 inch less than that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	26·6 lbs. on the 28th.
	Mean Pressure	1·0 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	W.

(Prevailing direction during the same month for the preceding 20 years, W.)

Temperature	Highest in the Shade ...	67·2 on the 29th.
	Lowest in the Shade ...	41·2 on the 15th.
	Greatest Range	20·4 on the 16th.
	Highest in the Sun ...	125·3 on the 23rd.
	Lowest on the Grass ...	33·5 on the 15th.
	Mean Diurnal Range ...	11·0
	Mean in the Shade ...	55·3

(Being 0·6 greater than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	99·0 on the 5th at 9 p.m., and on 28th at 9 p.m.
	Least	46·0 on the 12th, at 3 p.m.
	Mean	79·2

(Being 7·4 greater than that of the same month on an average of the preceding 20 years.)

Rain... ...	Greatest Fall	2·751 inches on the 8th.
	Number of Days	16 rain and 7 dew.
	Total Fall	6·324 inches. 65 feet above ground. 10·166 inches. 15 in. above ground.

(Being 7·375 inches greater than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	1·747
Ozone ...	Mean Amount	9·1

(Being 3·8 greater than that in the same month on an average of the preceding 18 years.)

Electricity...	Number of Days Lightning	1
Cloudy Sky	Mean Amount	6·6
	Number of Clear Days ...	2
Meteors ...	Number observed	2

Remarks.

On 5th and 6th there was a moderate S.E. gale; began with barometer 30·2. Barometer rose as wind backed to south. The rainfall at Sydney this month is 7·375 inches above the average. Abundant rain has fallen at most stations. Floods in Hawkesbury, Hunter, and other rivers. 7th, Hunter up 30 feet. At a few places the fall has been slight, but no station has been without rain during the month. The heaviest rain, has as usual been along the coast and high lands. The maximum, 15 inches, was recorded at Port Macquarie. Early in the month floods occurred in the district about Tamworth, and they extended down the Namoi past Gunnedah and Narrabri. At the end of the month (28th) floods occurred in the same district; and the Hawkesbury rose 20 feet at Penrith; the Macquarie and the Bell Rivers were also in flood. Throughout the month the steamers have traded up the Darling as far as Brewarrina. On 21st dense fog in the harbour; objects could not be seen at a distance of 100 yards.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ EAST.

SEPTEMBER, 1879.—GENERAL ABSTRACT.

Barometer ...	Highest Reading	30·117 in. on the 11th, at 10·50 a.m.
At 32° Faht.	Lowest Reading	29·352 „ on the 16th, at 3 p.m.
	Mean Height	29·775
(Being 0·109 inch less than that in the same month on an average of the preceding 20 years.)		
Wind ...	Greatest Pressure	20·5 on the 16th at 9 a.m.
	Mean Pressure	0·9
	Number of Days Calm ...	0
	Prevailing Direction ...	W.
(Prevailing direction during the same month for the preceding 20 years, W.)		
Temperature	Highest in the Shade ...	74·1 on the 23rd.
	Lowest in the Shade ...	45·7 on the 7th.
	Greatest Range	65·2 on the 2nd.
	Highest in the Sun ...	132·6 on the 23rd.
	Lowest on the Grass ...	39·5 on the 30th.
	Mean Diurnal Range ...	11·4
	Mean in the Shade ...	59·6
(Being 1·0 greater than that of the same month on an average of the preceding 20 years.)		
Humidity ...	Greatest Amount	100·0 on the 16th.
	Least	45·0 on the 23rd.
	Mean	79·1
(Being 9·5 greater than that of the same month on an average of the preceding 20 years.)		
Rain	Greatest Fall	5·691 inches on the 10th.
	Number of Days	16 rain and 5 dew.
	Total Fall	8·699 inches. 65 feet above ground. 14·045 inches. 15 feet above ground.
(Being 11·373 inches greater than that of the same month on an average of the preceding 20 years.)		
Evaporation	Total Amount	2·229 inches.
Ozone ...	Mean Amount	9·2
(Being 3·7 greater than that in the same month on an average of the preceding 18 years.)		
Electricity ...	Number of Days Lightning	2
Cloudy Sky ...	Mean Amount	6·5
	Number of Clear Days ...	2
Meteors ...	Number observed ...	1

Remarks.

The temperature this month is 1 degree above the average, and the month has been remarkable for very heavy rains. At Sydney the fall is 11·373 inches above the average. Inland abundant rains have fallen during this month, especially along the coast and high lands; the greatest record is at Cordeaux River, 21·50, and at fifteen stations the fall exceeded ten inches; with such an abundant rainfall it is not surprising that several high floods took place. On the 30th of August the Hunter was 24 feet above its usual level at Maitland, on the 8th of the month a very heavy general rain began, and by the 10th the Hawkesbury was in high flood. At Penrith it rose 30 feet, and at Windsor 46 feet. The Hunter also had risen 26 feet at Maitland, 23 feet at Singleton. The Macquarie at Bathurst rose higher than any other flood for thirteen years. Again on the 17th, the Hunter at Maitland rose 28½ feet, and the Hawkesbury was again in flood. On the night of the 16th the highest flood ever known in the Macquarie took place at Bathurst. At Wellington the rise was 32 feet. At Araluen the flood was the highest since 1860. At Wagga Wagga the rise was 33 feet 6 inches. Serious floods also threatened Bourke. The northern rivers were also flooded, and at Coonamble the flood waters came into the town. At Brewarrina the river was more or less affected by flood waters all the month. Easterly gale with heavy rain, 7th, 8th, and 9th; heavy floods in coast rivers on 10th; floods also on the western slopes same date.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 46s; MAGNETIC VARIATION, 9° 25′ 2″ East.

OCTOBER, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·169 inches on the 14th, at 9 a.m.
	Lowest Reading	29·430 „ on the 28th, at 4 p.m.
	Mean Height	29·820

(Being 0·015 inch less than that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	28·9 lbs. on the 23rd.
	Mean Pressure	0·6
	Number of Days Calm ...	1

(Prevailing direction during the same month for the preceding 20 years, N.E.)

Temperature	Highest in the Shade ...	95·0 on the 23rd.
	Lowest in the Shade ...	47·8 on the 1st.
	Greatest Range	28·4 on the 17th.
	Highest in the Sun ...	146·0 on the 23rd.
	Lowest on the Grass ...	39·6 on the 1st.
	Mean Diurnal Range ...	15·6
	Mean in the Shade ...	63·6

(Being 0·1 greater than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	88·7 on the 8th.
	Least	41·7 on the 23rd.
	Mean	69·2

(Being 0·5 greater than that of the same month on an average of the preceding 20 years.)

Rain	Greatest Fall	1·153 inches on the 9th.
	Number of Days	11 rain and 1 dew.
	Total Fall	1·451 inches. 65 feet above ground. 2·975 inches. 15 in. above ground.

(Being 0·171 inch greater than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	4·439 inches.
Ozone ...	Mean Amount	8·6

(Being 3·1 greater than that in the same month on an average of the preceding 19 years.)

Electricity ...	Number of Days Lightning	3
Cloudy Sky	Mean Amount	5·0
	Number of Clear Days ...	5
Meteors ...	Number observed... ...	0

Remarks.

Temperature and rainfall this month are close to the average, but on the 23rd it was unseasonably hot, the maximum reaching 95°. Excepting the northern coast districts, where very little rain fell, there has been generally a fair supply, ranging from 2 to 3 inches.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10h 4m 46s; MAGNETIC VARIATION, 9° 25′ 2″ East.

NOVEMBER, 1879.—GENERAL ABSTRACT.

Barometer ... At 32° Faht.	Highest Reading	30·420 in. on the 28th, at 11·30 p.m.
	Lowest Reading	29·070 „ on the 19th, at 3·10 p.m.
	Mean Height	29·633

(Being 0·173 inch less than that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	22·4 lbs. on the 26th.
	Mean Pressure	0·6 lb.
	Number of Days Calm ...	0
	Prevailing Direction ...	E.N.E.

(Prevailing direction during the same month for the preceding 20 years, S.)

Temperature	Highest in the Shade ...	84·1 on the 17th.
	Lowest in the Shade ...	52·2 on the 28th.
	Greatest Range	26·3 on the 30th.
	Highest in the Sun ...	140·8 on the 13th.
	Lowest on the Grass ...	44·2 on the 28th.
	Mean Diurnal Range ...	14·3
	Mean in the Shade ...	66·1

(Being 0·5 less than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	94·0 on the 19th.
	Least	51·0 on the 23rd.
	Mean	70·0

(Being 0·7 greater than that of the same month on an average of the preceding 20 years.)

Rain	Greatest Fall	1·740 inches on the 20th.
	Number of Days	14
	Total Fall	2·819 inches. 65 feet above ground. 3·562 inches. 15 in. above ground.

(Being 0·116 inch greater than that of the same month on an average of the preceding 20 years.)

Evaporation	Total Amount	4·705 inches.
Ozone ...	Mean Amount	8·8

(Being 3·6 greater than that in the same month on an average of the preceding 19 years.)

Electricity ...	Number of Days Lightning	7
Cloudy Sky	Mean Amount	6·6
	Number of Clear Days ...	0
Meteors ...	Number observed ...	1

Remarks.

This month the temperature is rather less than the average, and the rainfall moderate, the greatest fall being 5·93 inches at Grafton. Generally the fall has been from 1 to 3 inches, but at Dubbo only 0·21 was recorded. The heaviest rains were on the 11th and 12th of the month.

GOVERNMENT OBSERVATORY, SYDNEY.

LATITUDE, 33° 51′ 41″; LONGITUDE, 10° 4′ 46″; MAGNETIC VARIATION, 9° 25′ 2″ East.

DECEMBER, 1879.—GENERAL ABSTRACT.

Barometer... At 32° Faht.	Highest Reading	30·050 inches on the 30th.
	Lowest Reading	29·055 „ on the 21st.
	Mean Height	29·668

(Being 0·079 inch less than that in the same month on an average of the preceding 20 years.)

Wind ...	Greatest Pressure	25·9 on the 1st.
	Mean Pressure	0·5
	Number of Days Calm ...	0
	Prevailing Direction ...	S.

(Prevailing direction during the same month for the preceding 20 years, E.N.E.)

Temperature	Highest in the Shade ...	96·5 on the 1st.
	Lowest in the Shade ...	55·6 on the 29th.
	Greatest Range	30·3 on the 1st.
	Highest in the Sun ...	150·2 on the 1st.
	Lowest on the Grass ...	49·3 on the 9th.
	Mean Diurnal Range ...	12·7
	Mean in the Shade ...	68·2

(Being 1·4 less than that of the same month on an average of the preceding 20 years.)

Humidity ...	Greatest Amount	90·0 on the 25th.
	Least	54·0 on the 1st.
	Mean	72·4

(Being 2·5 greater than that of the same month on an average of the preceding 20 years.

Rain... ...	Greatest Fall	0·432 inches on the 28th.
	Number of Days	15 rain and 1 dew.
	Total Fall	1·345 inches. 65 feet above ground. 1·814 inches. 15 in. above ground.

(Being 0·500 inch less than that of the same month on an average of the preceding 20 years.)

Evaporation ...	Total Amount	6·099 inches.
Ozone ...	Mean Amount	7·0

(Being 2·4 greater than that in the same month on an average of the preceding 10 years.)

Electricity...	Number of Days Lightning	3
Cloudy Sky...	Mean Amount	6·6
	Number of Clear Days ...	1
Meteors ...	Number observed	0

Remarks.

Mean temperature is 1·4 less than the average, but on the 1st of the month the maximum rose to 96·5. The month has been dry inland, but not windy. On the coast and mountain districts there has been this month a fair supply of rain, the heaviest being in the northern coast districts, reaching a maximum fall of 8 inches at Port Macquarie. In the western river districts there has been little rain—in many places none at all. The temperature has been generally moderate, and rather below the average for December. Remarkable thunderstorm passed over on 28th; sky looked like a winter westerly wind.

LIST OF PUBLICATIONS.

TRANSACTIONS OF THE PHILOSOPHICAL SOCIETY OF NEW SOUTH WALES, 1862-1865.

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TRANSACTIONS OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1867.

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JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1876.

Vol. X.

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JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1877.

Vol. XI.

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JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1878.

Vol. XII.

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(Edited by Prof. Liversidge and Dr. Leibius.)

PAPERS READ BEFORE THE SECTIONS.

JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES, 1879.

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(Edited by Prof. Liversidge.)

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